PB-248 773

EMISSION DENSITY AND ALLOCATION PROCEDURES FOR MAINTAINING AIR QUALITY

R. K. Brail, et al

Rutgers - The State University

Prepared for:

Environmental Protection Agency

June 1975

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE

026127

EPA-450/3-75-079

June 1975

PB 248 773

EMISSION DENSITY AND ALLOCATION PROCEDURES FOR MAINTAINING AIR QUALITY

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
US Department of Commerce
Springfield, VA. 22151

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-450/3-75-079	2.
3. RECIPIENT'S ACCESSION NO.	
4. TITLE AND SUBTITLE Emission Density and Allocation Procedures for Maintaining Air Quality	5. REPORT DATE June 1975 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) R.K. Brail, D.R. Mandelker, T.A. Sherry and G. Hagevik	8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Center for Urban Policy Research Rutgers University New Brunswick, New Jersey 08903	10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO. 68-02-02-78
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Protection Agency Office of Air and Waste Management Office of Air Quality Planning and Standards Research Triangle Park, North Carolina 27711	13. TYPE OF REPORT AND PERIOD COVERED 14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES	

16. ABSTRACT

The ratio of the mass of an air pollutant emitted per unit of land area in any given time interval forms the basis of emission control regulations based on land area. This report examines four types of such regulations: emission allocations, floating zone emission quotas, district emission quotas, and emission density zoning. Experience with floating zone emission quotas in Jefferson County, Kentucky and with emission density zoning in Cook County, Illinois is examined. Legal issues relating to equal protection and due process, and methodological concerns relating to the integration of land use planning and air pollution control, are discussed.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Planning and Zoning Area Emission Allocations Land Use Emission Standards	Emission Density Zoning Emission Allocation Planning Emission Quota Strategies	

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 104
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE 5.50

EPA Form 2220-1 (9-73)

EPA-450/3-75-079

EMISSION DENSITY AND ALLOCATION PROCEDURES FOR MAINTAINING AIR QUALITY

by

R. K. Brail, D. R. Mandelker, T. A. Sherry,
and G. Hagevik

Center for Urban Policy Research
Rutgers University
New Brunswick, New Jersey 08903

Contract No. 68-02-0278

EPA Project Officer: John Robson

Prepared for

ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Mangement
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

June 1975

iv

This report is issued by the Environmental Protection Agency to report technical data of interest to a limited number of readers. Copies are available free of charge to Federal employees, current contractors and grantees, and nonprofit organizations - as supplies permit - from the Air Pollution Technical Information Center, Environmental Protection Agency, Research Triangle Park, North Carolina 27711; or, for a fee, from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

This report was furnished to the Environmental Protection Agency by Center for Urban Policy Research, New Brunswick, New Jersey 08903, in fulfillment of Contract No. 68-02-0278. The contents of this report are reproduced herein as received from Center for Urban Policy Research. The opinions, findings, and conclusions expressed are those of the author and not necessarily those of the Environmental Protection Agency. Mention of company or product names is not to be considered as an endorsement by the Environmental Protection Agency.

Publication No. EPA-450/3-75-079

ACKNOWLEDGEMENTS

This monograph was prepared under Contract No. 68-02-0278 between the United States Environmental Protection Agency and Rutgers University, entitled Contribution of Urban Planning to Air Quality. Richard K. Brail, Associate Professor of Urban Planning, Livingston College, Rutgers University, edited the monograph and contributed to Chpt. 1, 4 and 5. Daniel R. Mandelker, Howard A. Stamper Professor of Law, Washington University, and Thea A. Sherry, J.D., Washington University, 1974, directed the legal research, contributing to Chpt. 1, 2, 3 and 5. The legal research for the project was conducted at Washington University School of Law (St. Louis). Washington University law students participating in the study in addition to Thea Sherry were Gary Feder, Elizabeth Levine, David Miller, Stephen Pressman, and Lawrence Singer. Claire Halpern, J.D., Washington University, 1975, provided additional editorial assistance. George Hagevik, Chief, Environmental Division, Association of Bay Area Governments, Berkeley, California, contributed the section on California in Chpt. 2. John Robson, Project Officer, deserves a special note of appreciation for his editorial and production assistance.

CONTENTS

Chapter		Page
1	EMISSION QUOTA STRATEGIES	1-1
	Emission Quota Strategies	1-3
	Emission Allocation Planning	1-4
	Floating Zone Emission Quotas	1-7
	District Emission Quotas	1-8
	Emission Density Zoning	1-9
2	APPLICATIONS OF EMISSION QUOTA STRATEGIES	2-1
	Cook County Emission Density Zoning	2-2
	Jefferson County Floating Zone Emission Quotas	2-3
	Jurisdictional Problems in Cook and Jefferson Counties	2-6
	Emission Allocation Planning in California	2-9
	The Approach	2-9
	Developments from 1973 through mid 1975	2-13
	Emission Allocation as a Legislative Mandate	2-16
	California's Approach to Air Quality Maintanance Planning	2-16
	Conclusion	2-17
3	LEGAL ISSUES	3-1
	The Quota Problem	3-3
	The Taking Issue	3-8
	Conclusions on the Legal Issues	3-13
4	METHODOLOGICAL CONCERNS	4-1
	Current Proportions Allocation	4-2
	Future Configurations Allocation	4-5
	Earlier Work	4-6
	Land Use Planning	4-9
	Integrating Land Use Planning and Emission Quotas	4-12
	The Emissions Inventory	4-13
	Future Land Use and Transportation Configurations	4-14
	The Development of Emission Factors	4-17

Source Configurations 4-25
Stack Height 4-25
Stack Location 4-26
Mobile and Indirect Sources 4-27
Conclusion 4-30

5 THE FUTURE USE OF EMISSION QUOTA STRATEGIES 5-1

Problems and Prospects 5-1
Recommendations 5-4

Appendix

A IMPACT OF SB 98 - AIR POLLUTION EMISSION LIMITS A-1

B GLOSSARY OF LEGAL TERMS B-1

Technical Report Data Sheet C-1

CHAPTER ONE

EMISSION QUOTA STRATEGIES

Congressional enactment of the Clean Air Amendments of 1970[1] significantly strengthened the federal air quality program. As required by the Act, the federal Environmental Protection Agency (EPA), has adopted national ambient air quality standards,[2] and implementation plans to achieve and maintain these standards have been prepared by all the states.[3] State implementation plans contain the enforcement strategies required by the Clean Air Act, and while emission limitations on pollution sources[4] are their principal enforcement technique[5] the states are also authorized to include land use controls in their implementation plans.[6] These controls may supplement the use of emission limitation measures that the statute requires.

Emission quota strategies are important as an air pollution control technique because they provide a link between the control of emissions at the source through emission limitation measures and the attainment and maintenance of the air quality standards at regional levels. The emission quota strategy designates the maximum amount of pollution allowable in any one area of the air quality region based on an analysis of present air quality and the assimilative capacity of the air to absorb additional pollution without violating air quality standards. New sources of pollution are approved only so long as they meet all applicable performance standards and related air pollution control regulations, and the emission quota for the area in which they are located is not exhausted. Once the emission quota for an area is exhausted no additional sources of pollution are allowed within that area.

Theoretically, emission quota strategies can be applied to all pollutants for which ambient air quality standards exist. Practically, they are best used for particulates and sulfur oxides resulting from stationary sources. The legal, methodological, and administrative aspects discussed here will focus on land use and stationary sources. It is in the controlling of particulates and sulfur oxides from stationary sources that the few examples of emission quota strategies exists.

Basic to the implementation of any emission quota strategy are: (1) translation of existing and proposed land use activities into equivalent pollution emissions; (2) the determination of the maximum amount of emissions which the air quality standards allow; and (3) the establishment of constraints on new development which will keep pollution levels within these limits. While theoretically simple to conceptualize, this process creates many technical problems of execution which may be difficult to overcome in practice. One problem arises from the difficulty of translating land use activities into expected pollutant emission rates. Some technical work has been done in this area; a basic discussion will follow. Problems also arise in determining the impact on ambient air quality standards of a given level of emissions in any one regional sub-area. This determination can be made through the use of proportional or dispersion models which relate emissions output to air quality levels. Difficulties particularly arise in disaggregating data collected on a regional level to sub-areas within air quality regions.[8] Unless this

step can be executed, a data base for emission quotas cannot be provided, since these quotas are necessarily applied at the sub-area level.

The completion of these three steps involves the preparation of a set of emission quotas for each sub-area of an air quality control region. If the emissions from a parcel of land are known, a basis is established for the regulation of the emissions through direct controls applied to stationary sources. Simply, if in a given sub-area a designated increase in emissions will lead to a violation of the air quality standards, land development controls can be exercised to prevent the approval of a new source if that source will encrease new emissions to a level in excess of the permitted maximum. It is this linkage between new source approval, pollutant emissions, and maintenance of air quality standards that sets the stage for emission quota strategies.

Emission Quota Strategies

The recent EPA document on control strategies for air quality maintenance planning and analysis[9] includes a discussion of emission allocation planning and emission density zoning. Both strategies limit emissions to prescribed levels within defined areas, and have implications for land use patterns. These two strategies, along with two others, are all different techniques for developing and enforcing emission quotas. The four emission quota strategies which will be discussed are:

1. Emission allocation planning
   (Jurisdictional emission quotas)
2. District emission quotas
3. Floating zone emission quotas
4. Emission density zoning
   (Unit area emission quotas)

The attempt has been to develop a set of new labels for tnese emission quota strategies because of the ambiguities which exist over what the terms "emission allocation planning (or procedures)" and "emission density zoning" mean. As will be seen, the land use planning implications of these four different strategies vary. As each strategy is discussed, it is important to remember that they are best used for stationary source pollutants such as sulfur dioxide and particulates.

The basic elements in an emission quota strategy are the translation of ambient air quality standards into maximum emission quotas for each sub-area of the air quality control region, and the application of the quota on a case-by-case basis to new stationary sources of pollution as approval for construction or modification of these sources is requested. In practice, at least four methods exist through which emission quotas can be applied. The first method does not tie the quota to a zoning district or specially designated emission quota district within a municipality, but applies the quota to entire local government jurisdictions. Each of the other three methods applies the quota to an area smaller than a local government jurisdiction, but these methods differ in the way in which these areas are defined.

Emission Allocation Planning (EAP). The most broadly conceived of the emission limitation techniques centers on placing lids on the amount of pollutants emitted within defined political boundaries, including municipalities, and counties.[10] While one work[11] has referred to this jurisdictional emission quota concept as emission density zoning, this strategy has been usually referred to as emission allocation procedures or emission allocation planning (EAP). California has been the most advanced in its thinking about emission allocation

planning,[12] where a ceiling would be established on the total amount of emissions in an air basin and this total allocated to sub-areas within the basin. Extrapolating from the California experience, it becomes apparent that EAP is a flexible tool which allows local political jurisdictions a great deal of latitude in dealing with air quality problems.

Under this procedure the air pollution control agency allocates permissible emission quotas by local government jurisdiction within its region.[13] No attempt is made directly to apply the emission quota to new stationary sources. Instead, each local government may meet its assigned quota any way it wishes, whether by stationary source controls or otherwise. This system is attractive because the emission quota does not necessarily freeze development out of any one sub-area. Each governmental unit must decide how to allocate its assigned emissions. This flexibility should allow each local government to meet its emission quota without adopting overstringent regulations that raise legal problems (unless, of course, the area has not yet attained air quality standards).

It is this flexibility which is appealing and, at the same time, potentially dangerous. The allocation of a quota in itself provides no guidance to the local area, and EAP may be such a loosely-drawn concept that it would be ineffectual in maintaining air quality. Regulations would have to be developed to mandate compliance by jurisdictions with the quotas assigned, and might include mandatory review of land use and transportation plans as well as monitoring of zoning and subdivision regulations, including variances. There is no doubt that EAP has appeal as an air quality maintenance strategy.

Land use planning is an important component of EAP. The jurisdiction must be able to determine the kind and magnitude of growth which can be allowed within the total quality of emissions generated from different land use and transportation configurations. The jurisdiction will then be able to make reasonable judgements about what kind of industrial, commercial, residential, institutional and transportation activities should be encouraged or discouraged.

Clearly, the amount and nature of growth which can be allowed takes on another dimension when the region is already in violation of primary standards. In this situation, achievement of standards necessarily implies stronger controls on existing sources and activities before growth can be permitted.

The presumption here, of course, is that there exists some fixed amount of a pollutant which may be generated by sources within the jurisdiction. However, there exists no suitable mathematical model of air shed assimilative capacity to derive the fixed emissions ceiling. Some type of proportional or dispersion model utilizing monitoring data has to be used to relate expected emissions to ambient air quality. In the California situation,[14] current shares of total regional emissions of a pollutant are carried forward to future years for each jurisdiction.

Land use planning, then, operates in EAP as a basic reference point from which emissions in future years are estimated. By knowing aggregate amounts of future activity, planners can apply emission factors to convert land use projections into jurisdictional emission levels. These projected levels can be compared with the quotas, and a determination

made about the viability of the projected development of the area.

Floating Zone Emission Quotas (FZEQ). As the name implies, the "floating zone emission quota" concept refers to limitations on pollutants generated within an area of specified size which can be drawn about any specific location within the metropolitan area. For example, air quality maintenance objectives might include a limiting of emissions to 2,000 tons of particulates within any one square mile of the air quality maintenance area. The quotas may be uniform throughout an air quality maintenance area, or they may vary according to location. The use of floating zone emission quotas is best seen when evaluating the impact of a new industrial facility. Given this 2,000 ton per year limitation on particulates within a square mile, then a circle, containing an area of a square mile, could be placed about the proposed location of the new industry, the center of the circle. Thus, if the new industry is estimated to emit 200 tons of particulates per year, then the one square mile surrounding the industry must have existing total emissions of no more than 1,800 tons of particulates. The FZEQ concept was developed for use in Jefferson County, Kentucky.

This variant of an emission quota system has the advantage that there need be no advance detailed designation of districts within which the emission quota is to be applied. Any decision to deny approval of a new stationary source will be deferred until such time as the emission quota is exceeded. New sources of pollution will be disallowed only if the quota is exceeded within the prescribed radius of the new facility. So long as the site on which a source is denied can be put to some other use, the legal problems that are likely to arise will be mitigated.

Unfortunately, the floating zone emission quota system relies in

part on adequate spacing between sources to avoid over-saturation of emission quota control areas. If the denial of a permit under the floating zone emission quota system occurs in an area that is zoned locally for industry, and in which no other type of development is feasible, legal problems may arise. These will be discussed in more detail below.

District Emission Quotas (DEQ). A step down from EAP is a strategy which limits the amount of pollutants to be emitted during some time perood from a planning district within a jurisdiction. Thus, the amount of emissions generated by an industrial zone of 100 acres might be limited to no more than 200 tons of particulates per year. Once the emission limitations had been established for a particular district, new polluting sources would only be allowed if the quota had not been exceeded. The emission quota districts established could have the same boundaries as zoning districts. Different kinds of districts, e.g., residential, commercial, and industrial, would be permitted varying amounts of emissions. Through this strategy, "hot spots" could be avoided and air quality possibly maintained.

This approach to emission quota controls can lead to individual hardships and legal complexities because decisions to allocate permits for new sources will presumably be made on a first-come basis. Hence, each proposed source will be allowed until the full quota has been exhausted.

Assume, for example, that a facility is proposed which will utilize 90 per cent of the emissions allocated to an emission quota zoning district in a relatively small area of that district. The air pollution control agency might well take the position that the allocation of

emissions to this facility is "unfair". First, the allocation to this single facility will exhaust too much of the quota. Second, the emission quota ought to be more evenly distributed among polluters located within the district. This position will be very hard for the control agency to defend without some supportable criteria under which it can be made, and those criteria are difficult to discern. In particular, there is no guarantee that a refusal of approval to a "heavy" polluter guarantees the arrival, soon thereafter, of a series of "light" and area-extensive polluters that would utilize the emission quota in smaller increments. The market cannot be relied upon to behave in so precise a fashion.

Therefore, the control agency will of necessity be forced to distribute available emissions on a first-come basis. In the case discussed above, if an early entrant exhausts a substantial portion of the emission quota he will foreclose entry by other, and possibly lighter, polluters. In this situation, legal problems may arise due to the manner in which the emission quota has been allocated. The question is whether a first-come basis for allocating the emission quota is legally defensible. Even more serious legal problems will be presented if the next-in-line polluters find that they can make no reasonable use of their land if they are denied the polluting facility they had proposed. These legal questions will be discussed below.

Emission Density Zoning (EDZ). This phrase, "emission density zoning," has been used to cover a widely varying group of different land use-based air quality management strategies. For example, Bosselman, et al.[15] uses the term to encompass both emission allocation planning and district emission quotas. For our purposes here, emission density

zoning (EDZ) will be defined as an air quality maintenance strategy which requires that emissions of a pollutant be limited to prescribed levels for a selected unit area.[16] Thus, EDZ might be more properly labelled "unit area emission quotas."

It is important to understand that EDZ is perhaps best conceptualized as an emission quota assignment to a fixed unit of land in single ownership. The pollutant limit could be developed in terms of an amount per unit area per time period specific to a particular land use category. For example, an EDZ regulation might specify that a heavy industrial facility seeking to construct in a municipality must emit no more than two tons of particulates per acre of lot size per year. Hence, a 100 acre establishment classified as heavy industry would have to certify that it would emit less than 200 tons of particulates yearly before being allowed to construct.

It is not necessary to tie EDZ to land use zoning, as is done in this example, but it may be advisable for enforcement reasons. In this example compliance can be achieved within the existing zoning framework by each source as requests for approval are presented, since each source can comply with the quota by purchasing the necessary amount of additional land. Practical problems of implementation may arise, however, if no land is available for purchase near the site of the stationary source, or if owners of available land hold out for premium prices. Unwanted dispersal of new sources may result. Alternatively, low density development may be produced by heavy polluters forced to buy large amounts of land in order to meet the emission limitation.

NOTES

1. 42 U.S.C. Sec. 1857 et seq. (1970).

2. 42 U.S.C. Sec. 1857c-4 (1970).

3. 42 U.S.C. Sec. 1857c-5 (1970).

4. See 42 U.S.C. Sec. 1857c-6 (1970), authorizing EPA to set performance standards for new stationary sources of pollution.

5. See Natural Resources Defense Council v. EPA, 489 F.2d 390 (5th Cir. 1974).

6. For discussion see F. P. Bosselman, D.A. Feurer, & D. L. Callies, EPA Authority Affecting Land Use, Ch. III (1974) [Hereinafter cited as Bosselman]; Mandelker & Rothschild, The Role of Land-Use Controls in Combating Air Pollution Under the Clean Air Act of 1970, 3 Ecology L.Q. 235 (1973).

7. See United States Environmental Protection Agency, Guidelines for Air Quality Maintenance Planning and Analysis, Vol. 3: Control Strategies, II-3 to II-10 (1974) [Hereinafter cited as Guidelines, Vol. 3].

8. See United States Environmental Protection Agency, Guidelines for Air Quality Maintenance Planning and Analysis, Vol. 13: Allocating Projected Emissions to Sub-County Areas (1974), for a discussion of a methodology for sub-county allocations.

9. Guidelines, Vol. 3.

10. Guidelines, Vol. 3., II-1 to II-14.

11. Bosselman.

12. Livingston and Blayney, Report on Guidelines for Relating Air Pollution Control to Land Use and Transportation Planning in the State of California (1973) [Hereinafter cited as Livingston and Blayney].

13. Guidelines, Vol. 3, II-1.

14. Livingston and Blayney.

15. Bosselman.

16. This technique has been explored in work done at the Argonne National Laboratory. A. S. Kennedy et al., Final Report on Air Pollution/Land Use Planning Project (1973).

CHAPTER TWO

APPLICATIONS OF EMISSION QUOTA STRATEGIES

There are a limited number of applications of emission quota strategies. Two case studies of actually implemented emission quota strategies will be discussed. Jefferson County, Kentucky and Cook County, Illinois have used emission quota systems. However, while Jefferson County Air Pollution Control District has maintained and improved its emission quota system, the Cook County Environmental Control Department has now abandoned its emission density zoning experiment.

Local experimentation with air pollution control techniques has been possible in these two states, Kentucky and Illinois, because local agencies have been given enforcement powers, partly because of difficulties in enforcement programs at the state level.[1] In Illinois, the state air pollution control agency did not delegate enforcement responsibility to each county but assumed control over implementation programs.[2] Cook County, however, had already developed an environmental control department and air pollution ordinance, so that both the state and county agencies have enforcement authority within the county. Control over air pollution in Kentucky had been centered in the state Air Pollution Board with limited local enforcement provisions.[3] Kentucky's implementation plan modified the enforcement structure by authorizing the Kentucky Air Pollution Board to create air pollution districts with concurrent enforcement powers. The plan had also proposed a set of exceedingly stringent pollution standards, but after widespread protest these standards were dropped.[4] The application

of emission quota strategies in Cook County and Jefferson County will be discussed in detail, followed by an examination of the proposed use of emission allocation planning in California.

Cook County Emission Density Zoning

Cook County[5] was one of the first in the country to set local air pollution performance standards for industry.[6] For more than ten years, the Cook County Environmental Control Department had performance standards which measured pollution in pounds/acre/year. In this way, the standards combined the measurement of pollutant emissions by each plant source with pollutant density by area. This approach is an emission density zoning system to the extent that emissions are measured on an acreage basis. Plants could reduce their unit area output by acquiring more acreage, thus foreclosing the possibility that additional plants would locate nearby and use up the pollutant allocation for that area.

In 1973 this EDZ technique was abandoned, and the county ordinance now measures emissions through stack sampling and a process weight rate approach.[7] This system estimates stationary source emissions by plant input and output, and no longer uses land area as a component of the performance standard.[8] Monitoring stations in the county measure ambient concentrations 30 feet above ground level.[9] Since emissions are not related to a fixed land area, the Chicago ordinance can no longer be classified as emission density zoning. By changing to process weight rate measurement and removing the spatial factor, the county turned away from an emission

density concept and has, in fact, abandoned it.

Cook County abandoned the earlier EDZ technique because the burden of compliance fell more heavily on smaller stationary sources. In theory, any plant, large as well as small, could meet the EDZ standards of the old ordinance without problems so long as it acquired a large enough site to control its emissions. The more land owned by the industry, the more a plant could emit. While any polluter theoretically could buy enough land to meet the EDZ unit area quota the system in practice was biased toward the larger sources. A larger source usually had the funds to buy more land if necessary, and larger sources usually had easier access to additional land for purchase.[10] Hence, the Department believes that the old ordinance was unfair to small polluters. The new process weight approach places a heavier compliance burden on larger sources. They emit more pollutants and so must adopt more stringent measures to reduce pollution emissions.

Jefferson County Floating Zone Emission Quotas

The emergence of an environmental concern in Jefferson County is no surprise. Jefferson County is the home of the first Ecology Court in the country, ecology has been an important political issue, and the county has had an air pollution control district since 1971 to administer its air pollution control program.[11] The air pollution control ordinance enacted by the district is generally similar to those enacted by other air pollution agencies, although it does not include the detail found in some other air pollution codes.[12] What is innovative in the ordinance is the section authorizing emission quotas.[13]

This section grew out of an emissions inventory conducted by the district, which indicated that the industrial pollutants, sulphur dioxide

and particulates, were the major source of pollution.[14] While the district Board found that compliance with emission limitations could be achieved on an industry basis, this approach did not produce an acceptable region-wide ceiling on air pollution.[15] Using the year 1975 as a target, the Board sought to develop a plan to overcome this problem, and to determine the maximum tolerable levels of industrial pollution for the county.[16] Working with atmospheric dispersion models (principally EPA's Air Quality Display Model), the Board established maximum limits for particulates and sulphur oxides. Once these limits were calculated, the Board partitioned the entire district into sections,[17] and imposed area limitations on pollution output on each section.[18] Using this methodology, the Board concluded that a circular area of one mile radius in a heavily industrialized area could not exceed emission limits of four thousand tons of particulates per year and eight thousand tons of sulphur dioxides.[19] If no area exceeded these limits, it was estimated that federal ambient air quality standards would not be violated. The Board realized that it was proposing an unusual approach to air pollution control. The proposed emission quota standard is more far-reaching than the conventional emission limitation strategies contemplated by the Clean Air Act.

Originally, the Board planned to use an atmospheric dispersion model as the basis for setting different emission quota standards for different sections.[20] This approach was dropped, and the controlling provision of the district's ordinance establishes a four thousand ton particulate and eight thousand ton sulphur dioxide limit for all circular areas of one mile radius. (This translates into 1270 and 2550 tons per square mile, respectively). The decision of the Board to impose the quota

in this manner avoids the possibility that the emission quota might have been challenged as inequitable. Developers could have argued that differential emission standards for different sections of the district were not justified. In addition, varying emission quota standards by sections would have encouraged the shifting of existing polluters into less polluted areas, thus dispersing but not reducing pollution in the district.[21]

Although the district Board takes pride in its emission quota standard, it must be observed that the district's success to date in reducing air pollution is due primarily to very tough enforcement of traditional stack and point source regulation.[22] Moreover, the emission quota has been used and enforced in practice without a major protest.[23]

As each new source comes up for approval, its effect on the emission quota is determined by estimating its emissions in an area within one mile of the proposed facility. New sources can be approved so long as the established uniform quota for the district is not violated within this radius. This system is an example of the floating emission density zoning concept.

Two industries have so far been denied the right to build or expand, but the denials were not challenged and in one case the industry relocated to another area of the district.[24] There is potential for a test case. Along the Ohio River there are 2000 acres of undeveloped land which have

been purchased by a local public Riverport Authority. The Authority is determined to use these acres to build a riverport and to develop new industry around it. However, the land in question is part of a larger area in which no future growth is permissible under the emission quota ordinance.[25] The scene is set for the Board's denial of the Authority's request for a permit to build.[26]

Jurisdictional Problems in Cook and Jefferson Counties

In both Louisville and Cook County, jurisdictional conflicts have arisen between the pollution control and zoning agencies. Emission quotas in their purest form require more than the traditional air quality enforcement effort. To function at their optimum, emission quotas require the coordination of air pollution standards with land use planning and controls. These functions by definition are delegated to the planning and land use control agencies.

In Chicago, the Cook County Building and Zoning Department has jurisdiction over the unincorporated portions of the county. About 127 municipalities make up the incorporated area of the county, and have been granted the power to zone within their own areas by state enabling legislation. The Cook County Environmental Control Department (ECD) has jurisdiction over both incorporated and unincorporated areas in the air pollution control program, but the ECD program must take account of and be coordinated with local zoning regulations.[27] To maintain air quality, all county departments must also cooperate to keep up the emission inventory on an industry by industry basis.[28] In addition, the county Board and Zoning Department enforces the zoning ordinance, which also contains zoning performance standards.[29] However, the ECD enforces the county's air pollution control performance

standards[30] as well as those required by the EPA.

Construction of a new industry begins with submission of a detailed plan indicating where it will locate, the manufacturing process to be used, and proof of compliance with air pollution control standards. The plan is reviewed by the County Zoning Department to determine zoning compliance[31] and is then sent to ECD.[32] Air pollution controls are enforced through a permit system which reviews plant operation, not land use. ECD determines what plant controls will be necessary to ensure compliance with national ambient air quality standards and compliance with the county air pollution control ordinance. In order to obtain a location and construction permit from ECD, the industry must show that it can meet the required standards. When the plant is completed it must also meet air pollution control operating standards before it can receive an operations permit from ECD.[33]

ECD cannot direct either the county or the municipalities on how to zone for industrial, residential or business uses, and must accept present and future land use patterns as determined by the county and municipal zoning ordinances. Without direct control over the use of land, the Environmental Control Department has little influence over the zoning pattern. The result is that the Environmental Control Department has the scientific knowledge to determine what areas are too heavily zoned for industry, but has no means of preventing a municipality from zoning for industry if this zoning is not indicated.[34] In addition, although ECD has enforcement powers in its permit system, it has not used its permit process to prohibit construction at locations considered undesirable from an air pollution standpoint.[35] One observer believes that emission density control with these limitations

is after-the-fact regulation.[36]

In Louisville, emission quota standards are not considered a zoning device, and the Board avoids even mentioning the word zoning in its ordinance. Furthermore, the Board willingly accepts the lack of professional planners on its staff. Planning and zoning powers are exercised by the Jefferson County Planning and Zoning Commission; this agency agrees that as emission quota standards are actively enforced these standards will preempt local zoning ordinances.[37] Both the Commission and the Board also agree that a super-agency should be created to achieve the necessary coordination, with existing agencies merely providing the information needed for regulation. There are other problems. First, even if court approved, the air pollution district's reliance on atmospheric dispersion models as the basis for the numeric estimates of emission quotas may be misplaced. These models are not completely reliable. Second, the district has never bothered to deal with industries whose stack heights are less than 30 meters.[38] Third, in order not to completely discourage growth, the county-wide limits on pollution are set at rather high levels.[39] The result, of course, is that pollution must be tolerated in areas where currently there is very little.

The emission quota controls implemented by the Jefferson County Air Pollution Control Board are limited as a land use measure. The Lousiville area will not provide a good model for combining land use and air pollution control functions until land use impacts are more explicitly considered in the emission quota strategy. Nevertheless, the Louisville system remains as the best example of an emission quota system currently in use.

Emission Allocation Planning in California

The emission allocation planning (EAP) approach developed in the state of California has evolved over the last three years. A discussion of the development of the approach in California is found in other publications and will not be reviewed in detail here.[40] Suffice it to say that the approach originated with an interest in introducing air pollution control into the planning activities of cities and counties. It was initially thought that an air pollution control element could be added to the general plan of all cities and counties in the state. It was quickly decided, however, that such a local, qualitative approach would not be adequate for dealing with a problem that is region-wide in scope. The California Air Resources Board recognized that an air basin-wide planning effort would be necessary.

The Approach. Although related to emission density zoning, emission allocation planning should be viewed as a more generalized technique concerned with regional air pollution problems. The focus is on the comprehensive land use plan as the basic document from which future levels of air quality are estimated. The purpose of emission allocation is to utilize land based emission factors to evaluate the air pollution potential of comprehensive land use plans within a defined region. The land use plans, therefore, need to be viewed as an accurate representation of the future development that can be expected in the region under study and thus assume a position of importance in estimating future levels of air quality.

The basic concept behind emission allocation is that there should

be some relationship established between total air pollutant emissions in a region and the assimilative capacity of the ambient air in the region, and that this relationship should be projected into the future to establish the total amount of emissions that can be allowed at some future point in time. The assumption is made that there is a fairly close relationship between urban growth and increasing levels of air pollution. Thus, if we had a picture of the future levels of land development in a region, one could select the type of air quality maintenance strategies that would be necessary to ensure that air quality standards will not be violated. The comprehensive land use plan provides this picture of future development. Thus, emission allocation planning is both an air quality management and land use planning technique.

The recognition of the potential importance of land use planning as a technique for maintaining air quality standards led the California legislature in 1973 to direct the California Air Resources Board (ARB) to prepare a report on proposed guidelines for the preparation of an air pollution control element in city and county general plans. In response to this mandate, the ARB let a contract to the consulting firm of Livingston and Blayney to prepare such a report in cooperation with the ARB staff.[41] However, as the study progressed in early 1973, it became apparent that air quality management can be effectively integrated with land use and transportation planning only on an air basin-wide basis. Accordingly, the procedures which the consultant recommended would vest responsibility for allocating air pollutant emissions limits within each air basin in the state in a regional agency.

Six steps were proposed in the consultant's report to integrate

air quality goals into the land use and transportation planning process under the emission allocation procedures.

1) Compile detailed inventories of air pollution emissions in planning sub-areas of an air basin. The assumption is made that present inventories for counties and the air basin are too generalized for detailed air quality planning.

2) Designate maximum emissions allowable in each planning sub-area to achieve and maintain air quality standards, based on an analysis of present air quality and the assimilative capacity of the air to absorb pollutants and still maintain air quality standards.

3) Project planning sub-area emissions likely to be generated by sources indicated in land use and transportation plans for designated future time periods and compare these emissions with the allowable emission limits.

4) Evaluate and revise land use and transportation plans so that prescribed emission limits would not be exceeded.

5) Adopt and implement land use and transportation plans which are prepared to meet air quality goals and standards.

6) Monitor public and private development through a refined environmental impact assessment process in which emissions projected directly or indirectly from proposed projects are accounted for in environmental impact reports.

The key to this process is the concept of allocating air pollutant emissions within an air basin. The emissions were to be allocated based on a proportional model which compared current ambient air concentrations, as monitored, and current emissions in the air basin

with federal air quality standards and future emissions allowable in meeting the standards. The planning sub-areas of the air basin would then be allocated the same percentage of current air basin emissions in the future. For example, assuming attainment of federal standards, then current emissions of sulfur dioxide might be increased by 10 percent in the air basin while still maintaining the standard. If the planning sub-area currently has 5 percent, or 100 tons of the total 2,000 tons of sulfur dioxide emissions in the air basin, then the sub-area could have 5 percent of the total allowable emissions in the future. The total allowable is 2,200 (a 10 percent increase), and the sub-area would be allocated 110 tons (5 percent of the total). This is an example of "current proportions allocation," discussed in Chapter 4.

As long as plans and projects conform to prescribed emission limits air quality standards will be maintained. An appeal process would permit deviation from prescribed limits where technical information is available to ensure that air quality standards will not be exceeded by the proposed deviation.

The designated regional agency in the air basin would compile the planning sub-area emissions inventory and then designate the emissions limits for each planning sub-area. City and county planning agencies would make emissions projections based on their land use and transportation plans, using emission factors provided by the Air Resources Board and the Environmental Protection Agency, and then adjust their plans to meet prescribed emission limits. Transportation planning agencies likewise would make projections of the emissions that would be generated by their proposed plans, and revise them accordingly.

A significant amount of interaction between the agencies involved would be necessary before all plans throughout an air basin met the prescribed limits.

Appeals to exceed emissions limits would be decided by the designated regional agency. Once the plans had been approved by this agency, the responsibility for implementing them would rest with the cities and counties. However, the designated regional agency would continue to monitor development through the environmental impact assessment process to ensure that emission limits would not be violated.

Developments from 1973 through mid-1975. In August of 1973, the Air Resources Board transmitted a "Report to the Legislature on Guidelines for Relating Air Pollution Control to Land Use and Transportation Planning in the State of California." This report contains, as an appendix, a report to the Air Resources Board by the consulting firm of Livingston and Blayney, city and regional planners.[42] The report and the appendix contain the basic elements of the emission allocation planning process. The Air Resources Board circulated these documents widely within the state of California, asking for comments from a variety of agencies, including air pollution control and land use planning agencies. At about the same time, Senate Bill 1543 was introduced in the legislature. This bill contained the basic elements of the emission allocation process. Like the material mentioned above, copies of SB 1543 were also widely reviewed within the state.

Over the next year, most of the discussion of the bill dealt with the role of various governmental institutions in implementing the process. Comparatively little discussion was addressed to the mechanics of implementing the process. The interest in the institutional aspects

of the bill can be traced in part to the designation of the basin-wide coordinating councils as the organization to carry out the emission allocations process. In California, basin-wide coordinating councils are groups of air pollution control districts within an air basin which come together to cooperatively deal with problems behond their jurisdictional boundaries. If the air pollution control district already has a region-wide jurisdiction, as is the case with the Bay Area Air Pollution Control District (BAAPCD), the district is then also the coordinating council. Thus, in the Bay Area, the BAAPCD would be the agency which would have implemented SB 1543.

Much of the opposition to the designation of the coordinating councils as the planning and implementing organization came from councils of governments (COGs). The COGs felt that the emission allocation approach was one more example of single purpose regional planning in California and that it would be more appropriate for the COGs to be the planning organization, with appropriate coordination with the air pollution control districts. Cities and counties, to a lesser extent, also expressed reservations about a new regional planning process which might result in the removal of some of their authority over land use and transportation decisions. During 1973 and 1974, the Reagan administration did not take a position on the bill.

The bill reappeared as SB 98 in December 1974 and was amended on January 14, 1975. The basic elements of the amended bill are found in Appendix A. This appendix, which describes the impact of SB 98 on the San Francisco Bay Area, contains the basic elements of the bill in what is presently its final form. One of the last amendments to the bill was the addition of a section which would authorize the Air

Resources Board to transfer the responsibility for allocating emission limits from a basin-wide coordinating council to a multi-functional regional organization encompassing an air basin if that organization has the responsibility for planning for air quality in the region. This amendment was added because of the criticisms noted above.

Another criticism of both SB 1543 and SB 98 is that the Air Resources Board maintains the authority to determine the emission limits within each air basin. Local air pollution control districts, in particular, wished to keep this authority within the regions and not have it reside in Sacramento. Discussion of this issue, however was minor compared to the concern with the institutional aspects of the bills.

With the arrival of SB 98, discussion finally started to focus on procedural issues. Support for the bill was usually qualified with a statement that the emission allocation approach as outlined is little more than a general framework that raises more questions than it answers. Requests were made to ARB that a major test of the procedures should be undertaken before full scale adoption of the approach statewide. For example, the choice of subdivisions to which emissions would be allocated within air basins is not discussed in the legislation. Would they be political subdivisions or rectangular grid cells? To representatives of local governments a question such as this is one of major importance.

In part, because of the lack of detail in the bill, SB 98 died in the Senate Local Government Committee in May 1975. The new administration of Governor Brown refused to support the bill. One reason suggested for this lack of support is that the implications of the bill could not be adequately understood. Until the Brown

Administration reached a point where the impact of the bill could be better determined, it seemed likely that support would not be forthcoming.

Emission Allocation As A Legislative Mandate. Although the death of SB 98 probably can be ascribed to a number of causes, one of the major reasons is that the bill would have mandated a uniform approach to air quality maintenance in all of the critical air basins within the state. A distinction must be made between a legislative mandate and a planning procedure which can be modified to suit local conditions. Thus, the lack of a legislative mandate does not mean that the emission allocation process will not be attempted within California. Even without a legislative mandate it seems likely that the Air Resources Board will actively seek to use the emission allocation approach or some derivative as the basis for air quality maintenance planning within California.

California's Approach to Air Quality Maintenance Planning. Environmental planning in California is somewhat unique in the United States since the National Environmental Protection Act of 1969(NEPA), is complemented by the California Environmental Quality Act of 1970 (CEQA), which requires environmental impact statements on private developments. These two project-by-project approaches to environmental analysis produce tremendous amounts of data, but these data lack a framework within which they can be effectively utilized. Some progress has been made in projecting levels of non-reactive pollutants associated with individual projects, but ARB staff often point out that there is no methodology for relating precursors of oxidant from individual projects to future oxidant levels in the individual air

basins within the state. Indeed, there is a steadily growing frustration with the lack of utility of the massive amounts of data being accumulated on individual projects which theoretically are to be a useful guide to decision making. The most reasonable technique for relating individual projects to region-wide air quality problems in the minds of the ARB staff is the emission allocation technique.

It is therefore very likely that the emission allocation technique will be refined by the ARB staff as part of the "plan development program" (PDP). The PDP is a two-phase approach for meeting EPA's requirements for the preparation of an air quality maintenance plan. As presently proposed, the PDP approach seems to be the appropriate vehicle for determining whether emission allocation planning is a viable technique to be utilized as the basis for an air quality maintenance plan. Without the structures of a legislative mandate, the emission allocation approach can be modified and adapted to local needs within the state.

Conclusion. The emission allocation approach as proposed in the state of California is designed to deal with the area-wide oxidant problem. Although the approach has been suggested to be more suitable for non-reactive pollutants, the California Air Resources Board is primarily concerned with using the approach for evaluating the impact of individual projects on area-wide oxidant levels. The secondary objective is to use emission allocation as an overall framework for the air quality maintenance planning process. Although it is anticipated that the approach will be very useful in dealing with long-term issues of urban growth, the present dilemma of making effective utilization of information created under the NEPA and CEQA process

remains paramount. Since CEQA type legislation covering private development does not exist in most other states, one would have to raise the question of whether the emission allocation approach is appropriate for other parts of the country. The more or less self-contained airsheds within California gives any air basin-wide approach some validity. The difficulty of determining and controlling background concentrations in other parts of the country suggests that the emissions allocation model might not be as appropriate. However, without actual experience in attempting to apply the technique, questions raised concerning its effectiveness must remain hypothetical.

NOTES

1. Interview with Robert Offutt, Secretary Treasurer, Jefferson Air Pollution Control District, July 1973.

2. Interview with Dennis Hawker, Deputy, State of Illinois, Institute of Environmental Control, July, 1973; Interview with Mario Tonelli, Administrator, Cook County ECD, July, 1973.

3. This pattern of enforcement was primarily due to the absence of county or regional pollution agencies within the state.

4. The reaction to a tightening of pollution standards was quite negative, some critics claiming that growth in the area would be cut by three-quarters. As a result, the Kentucky implementation plan which was finally submitted to and approved by the EPA deleted any promise of stronger-than-minimum controls.

5. Cook County includes an area of 400 square miles but excludes the city of Chicago. Chicago has its own environmental control department.

6. See Salzenstein, Industrial Performance Standards, ASPO Planning Advisory Service, Rept. No. 272 (1971).

7. According to Mario Tonelli, the new ordinance is more in tune with the state, which has adopted stricter regulations. The ordinance was changed in April, 1973. Point sources are usually defined as a function of plant size which is sufficient for particulates process control. The Jefferson County Air Pollution Control Ordinance defines a point source as "any air contaminant source which emits 25 tons per year or more of either particulate matter or sulphur dioxide." Sec. 1.13.1.

8. Art. VI, Sec. 6.2-1(c) provides:

   > For purposes of the regulation, the total process weight from all similar process units at a plant or premises shall be used for determining the maximum allowable emission of particulate matter that passes through a stack or stacks.

9. Interview with Mario Tonelli.

10. By acquiring additional land the large industry can avoid violation of the emission density controls. On the other hand, if industries are forced to acquire additional land in order to comply with emission density controls they may have to locate in areas subject to non-degradation controls. The Illinois Institute of Environmental Control stated that the non-degradation issue was the reason why the state stayed away from emission density zoning. Interview with

Dennis Hawker, July, 1973.

11. Jefferson County is the only district that has been set up in Kentucky in recent years.

12. The Jefferson County ordinance is very short and broadly stated. According to one of its draftsmen, it was intended to inform industry of the basic requirements and to work through a tough enforcement policy.

13. Revised Ordinances of the City of Louisville, Ch. 34 Sec. 12 (1970).

14. These pollutants are of primary concern in Cook County and Louisville as they are the main pollutants produced by industrial plants. Louisville has a wide variety of industrial pollutants: synthetic rubber, whiskey, paint, tobacco, and coal. The coal industry, which has been traditionally a rural operation, had moved part of its operation to the Louisville area and had become especially troublesome from a pollution standpoint. Industry alone was creating approximately 788,000 tons of pollutants across the region per year. In addition, there are "hot spots" in certain areas in which rubber factories and power plants are located.

15. Interview with Robert Offutt.

16. The year 1975 was used as a working date because the district has set 1975 as a goal for meeting the Clean Air Act's primary and secondary standards for particulates.

17. Partitioning the county was done as part of the development of the Board's program. The sections were each 2 kilometers on a side.

18. That is, an emission quota would be enforced as an overlay upon point source standards. The number of proposed sections was fed into the diffusion model. The information gathered through the Emission Inventory enabled the Board to take existing as well as target pollution levels into account.

19. Ordinance, Secs. 1.13.3(A)(1); 1.13.3(A)(2)

20. E.g., the downtown quadrant would not have the same area standards as the east-county quadrant, which is virtually undeveloped, or the so-called "rubbertown" section, where much pollution is originating.

21. Public hearings were held prior to the enactment of the emission quota ordinance. To the surprise of the Board, there was little local protest over the proposal although three groups, land speculators, large property owners, and of course some industries, did complain that emission quota limits were too stringent. State officials were also skeptical.

22. As an example, the Board has required an industry like B. F. Goodrich to include in an annual report to the Board a review of 120

different functions carried on in its plant which can potentially produce pollutants. If the Board is dissatisfied with the industry's efforts in controlling any of these functions, it requires an improvement before allowing a permit to be renewed. By the summer of 1973 the Board reported that of 245 individual industries which in 1971 were producing an excessive amount of industrial pollution only 18 sources remained which had not sufficiently reduced their output. The Board attributes its success to its willingness to go to court to force industries to comply with point standards. Although the Board suggests that nearly 3,000 pollution cases have been heard by the District's Ecology Court it also dismisses all of these cases as minor.

23. One reason may be the leniency of the standard. Although perhaps acceptable in "rubbertown," 2550 tons per square mile per year of sulphur dioxide is hardly a desirable addition to a previously unpolluted area.

24. Telephone interview with Robert Offutt, April, 1975.

25. Two major power plants in that area have preempted the emission quota.

26. To date, the Board has worked with the Authority and has helped it to modify its plans to avoid this confrontation. Telephone interview with Robert Offutt, supra note 24.

27. Interview with Mario Tonelli; Interview with Dan Ferrone, Department of Planning, Cook County, July, 1973. Coordination is monitored by keeping up to date a grid map which pinpoints the sample stations. The grid map partitions the county into areas of high and low pollution concentrations. The Cook County Environmental Control Department will not approve a plant if it will cause a violation of primary or secondary air quality standards, but whether the location is beneficial or at least adequate from a land planning perspective is not within its jurisdiction to resolve.

28. The inventory is maintained through monitoring the sample stations dispersed throughout the area. If a station registers a high reading, inspectors are sent into the area to determing the polluting industry. Thus the ECD deals directly with each plant at its stack or cluster level.

29. Interview with Dan Ferrone. See also G. Hagevik, D. R. Mandelker, and R. K. Brail,The Contribution of Urban Planning to Air Quality, 6-1 to 6-29 (1974)

30. The zoning ordinance includes certain standards not necessarily

identical to the Environmental Control department standards for manufacturing, as well as noise control provisions. The county Zoning Department, however, did not appear to be very clear about the ordinance of the Environmental Control Department (and vice versa). It was unsure whether the requirements were identical, whether the unit of measurement was the same, or if either one preempted the other. It was confident, however, that the ordinances conformed. The ECD deals not only with the Zoning Department but also with the 127 municipalities of Cook County.

31. The Zoning Department has jurisdiction only over the unincorporated part of the county. In contrast, the Environmental Control Department has jurisdiction over the entire county, excluding the city of Chicago, which has set up its own environmental control department.

32. This Department has the scientific knowledge and the inspectors to accurately assess whether industry can meet the necessary performance standards established by the county.

33. After this, the plant is subject to regular inspections.

34. Both the Environmental Control Department in Cook County and the Air Pollution Control District in Jefferson County are staffed entirely by chemists and engineers. In neither are there plans to bring in attorneys or urban planners. Fred P. Bosselman, a prominent Chicago land use attorney, believes that the establishment of a centralized agency combining air pollution and land use control functions could be helpful. Interview, July, 1973. Mario Tonelli concur. The Cook County Environmental Control Department also agreed that an agency combining land use zoning and environmental control standards would be desirable. However, zoning as such was not applauded; basically, performance standards were considered separately from land use.

35. Interview with Mario Tonelli. The department will cite an industry for a violation or delay the appropriate permit until the standards are satisfied.

36. Interview with Marvin Salzenstein, President of Polytechnic, Inc., July, 1973.

37. Yet Dan Ridings, the Planning Commissioner, concedes that the Pollution Board is far better equipped than his agency to make such quasi-zoning decisions. Interview, July, 1973.

38. As a result, the numerous small industries presently being ignored may ultimately produce enough pollution to create a substantial increase in pollution levels.

39. Interview with Robert Offutt.

40. See, in particular, Hagevik, Mandelker, and Brail, supra note 29, Chpt. 9.

41. Livingston and Blayney, Report on Guidelines for Relating Air Pollution Control to Land Use and Transportation Planning in the State of California (1973).

42. Livingston and Blayney, supra note 41.

CHAPTER THREE

LEGAL ISSUES

This report has outlined some of the control and enforcement possibilities that are available in emission quota strategies, and has followed this analysis with a review of emission quota controls in the Chicago and Louisville metropolitan areas. We should now look more closely at some of the legal problems that are likely to arise in the use of emission quota procedures.

Legal issues in the emission quota context are likely to focus on two common constitutional restraints on the exercise of regulatory powers by public agencies, the equal protection and the due process clauses. The equal protection clause requires that public programs of regulation be administered fairly and equally among those affected, subject to criteria that distinguish reasonably among those subject to the program's controls and restraints. The due process clause prohibits any land use or associated regulation which has the effect of so restricting individual rights in property that no reasonable use may be made of the land. In this event, courts commonly find that the restriction is unconstitutional as a "taking" of property.

On their face, there is nothing inherently unconstitutional in the method of regulations utilized in emission quota regulations. These regulations rely on well-established principles of constitutional law which generally support any regulatory control that leads to cleaner air, improved atmospheric conditions, and improved public health. Problems may arise, however, because the regulatory assumptions underlying conventional zoning controls may not fully accommodate

the restraints on the private use of land which emission quotas impose. In conventional zoning, densities and uses are allocated throughout the community with the assumption that every parcel of land affected by the zoning regulation will be allowed some permitted use that will survive a constitutional attack. That is, every parcel is assigned a permitted use and density which is sufficiently permissive to avoid a due process "taking." Fairness of treatment and thus equal protection objections are avoided in conventional zoning through the use of criteria that allocate land uses and densities throughout the community on the basis of development policies that can be uniformly and consistently applied.

Emission limitation quotas proceed on a different premise, since the quota places a threshold limit on allowable emissions within the air quality region as assigned to specific geographic sub-areas. New stationary sources of pollution will be approved so long as these threshold limits are not exceeded. The difficulty is that the pollution holding capacity of a region or sub-area may not be altered, as density and use restrictions may be altered in conventional zoning, to afford greater leniency to individual sources in order to forestall constitutional attacks. The time must come when additional sources of pollution must be prohibited so that emission quotas will not be exceeded. As long as the emission quota does not unconstitutionally restrict new development, no constitutional problems are presented by their application to land development projects. Constitutional objections are raised when the application of air quality standards leaves the landowner with no constitutionally acceptable alternatives for the development of his land.

The Quota Problem

These issues can best be viewed from the vantage point of the applicant whose source has been disapproved under the circumstances that have just been outlined above. Let us take his equal protection argument first. Our unsuccessful applicant will allege that his application has been denied only because he was last in line, and that other sources with no greater merit than his have been approved merely because they were presented to the air pollution control agency earlier. We have indicated that emission quota controls will probably have to be administered on a first-come basis. Now we are suggesting that serious constitutional problems can be raised by the applicant who comes after the emission quota for an area has been filled, and who challenges the administration of emission quota controls solely on a first-come approach. His principal point is that a system of land use regulation that distributes development opportunities on this basis is unconstitutional because the criterion utilized to make the allocation--priority of application--cannot be sustained as a reasonably appropriate criterion under the equal protection clause.

Unfortunately, there is very little legal precedent on this issue. As Professor Krasnowiecki has pointed out, "there was a sense running through standard zoning that you cannot establish regulations for an area that would allow one landowner to deprive the other of a pro-rata share of permissible development."[1] In other words, as applied in the emission quota context, there seems to be acceptance of the principle that the quota cannot be filled on a first-come basis if development will be prohibited on any land subject to the quota after the quota has been exhausted. This problem does not arise under traditional

zoning ordinances. Traditional residential zoning assigns a density limitation to all zoning districts, but each parcel of land within the district is entitled to the allowable density. The density is not exhausted under a quota system for the district at a time prior to the time at which all land in the district has been developed.

There has been little judicial consideration of the quota problem.[2] Recently adopted no-growth ordinances in many municipalities which utilize a quota approach will no doubt test the constitutionality of the quota strategy, at least as applied to the limitation of residential growth. The issue has not yet been settled and will probably be extensively litigated.[3] Our impression, however, is that courts will be hostile to explicit quota programs that foreclose last-come developers from areas in which, but for the quota, they would have been allowed to develop their land.

As applied in the emission quota context, the possible adverse constitutional implications of a quota system are most serious in the fixed district form of emission quota zoning (DEQ). Under this kind of emission quota control, the quota is assigned by district and is capable of being exhausted before the last-come developer can get approval to build or modify his source. Quota problems are less serious under the emission allocation planning (EAP) procedure, since zoning agencies subject to EAP quotas can presumably adjust their zoning ordinances to meet the requirements of the quota allocation without using quota programs on a district basis. While some communities may find that they cannot stay within their assignments without adopting potentially over-restrictive regulations, a number of those may well be smaller residential suburbs in which no

development with a serious pollution potential is planned.

Problems may still arise under this system. For example, the emission allocation planning process does not contain a method to force communities to zone up to their emission threshold. Some communities may then adopt land development control policies that do not exhaust their emission quota. In this situation, pressure may be placed on other municipalities to accept development that is not allowed in the recalcitrant localities. Other problems may arise if some communities are so committed to heavily-polluting industrial development that they are unable to meet their assigned quota without adopting restrictions that raise constitutional problems.

Emission allocation planning may produce development inconsistent with comprehensive regional planning policies even if all communities in the region cooperate wholeheartedly in the EAP strategy. This problem arises because EAP bases the distribution of allowable emissions on the need to maintain air quality standards. When the regional emission quota is assigned to local governments, the quota assignments for each locality may force artificial development decisions in order to meet these assignments. Since the quota will be allocated by governmental area, each local government will be restricted to allowing development within the quota assigned to it. Distortions in land development may result that otherwise would be avoided if the quota could be absorbed more flexibily within the region. Allocating the emission quota assigned under EAP to each government in the region may therefore produce a haphazardly dispersed development pattern. Industry will locate in a random pattern in order to comply with the assigned governmental quotas.

Most probably, in view of these limitations, emission allocation planning will work best in areas in which governmental units are sufficiently large so that the emission quota assigned to each will not force distortion of the land development patterns that otherwise would be adopted. Alternatively, some method might be found for transferring emission allocations between communities so that planning policies are not distorted by the need to comply with the emission quota.[4] Finally, the comprehensive development plan for the region could be used as the basis for the assignment of emissions to jurisdictions. This presumes the availibility of such a regional plan and the acceptance by the counties and municipalities of the plan. Given the use of EAP in this way, the emission allocations can act as another element in a comprehensive urban development guidance system approach to ensuring rational regional development plans. This guidance system approach will be discussed more fully in the next chapter.

The quota problem will be easier to handle under the floating zone emission quota system as developed in Louisville. This variant of emission quota control has the advantage that it does not require the mapping of emission quota zoning districts in advance. Neither does it require the prior assignment of emission quotas to specific local government units. An application for a new source need not be denied unless the pollution it emits exceeds the quota for the area within which it is tested. Since the emission quota is not assigned to districts mapped in advance of applications for approval, the area in which a violation of the emission quota is tested varies as each new source is proposed. The margin of safety for each new

source thus increases the greater its distance from existing sources of pollution. As a result, there is less likelihood that new sources will be disapproved. Legal difficulties are likely to arise only if the application of the floating quota leads to disapproval of a new source on leftover land in an area in which existing development precludes any other reasonable use. This possibility may arise, but it is less likely to occur than under the district emission quota procedure. The problem is that the dispersal of stationary sources which the floating zone emission quota may require may not be compatible with existing and planned land development patterns.

The emission density zoning approach does not raise an equal protection problem. Individual polluters can comply with the emission quota simply by buying enough additional land to bring their emissions within the quota limits. No polluter will therefore be denied approval under this system because his application is presented after earlier approvals have exhausted an emission quota that is applied to a planning or zoning district, or governmental jurisdiction. Although the amount of land needed by a facility will vary with the amount of pollution emitted, the emission quota can be uniform for a particular zoning classification, such as heavy industrial, throughout the jurisdiction. The amount of land required varies proportionately with the amount of pollution emitted so that the uniform standard will not be exceeded. The emission density zoning system may present due process taking problems, however, if a polluter is required to purchase an excessive amount of additional land over the amount currently owned simply to absorb his pollution load.

The Taking Issue

A second legal problem arising under emission quota strategies is the so-called taking issue. A point may be reached in the application of emission quotas at which a last-come developer will be prohibited from constructing his facility but may not be able to put his land to any other reasonable use. An illustration using the district emission quota will indicate the nature of the problem:

> Assume a heavily industrialized area which is also designated as an emission quota zone under a district emissions quota (DEQ). Several undeveloped parcels remain in this area. New development is allowed to proceed for a time as the emission quota in the area is not exhausted. A point is then reached at which a new facility is approved which exhausts the quota. The next application is then denied. This application covered a plot of ground in the middle of the industrial area. Since the application for industrial use was denied, no other use is reasonable under the circumstances since non-industrial uses in a heavily industrialized area are out of the question. In effect, no further development of this parcel is allowable under the district emission quota.

Comparable restrictions on land development can arise, though under somewhat different circumstances, under the other emission quota strategies.

The question here is whether this restriction on the development of the last-come applicant's land is serious enough to warrant a finding by a court that the restriction is unconstitutional as a "taking" of property. Again, there is no clearcut law on this issue. Zoning ordinances have been held unconstitutional when they have frozen the uses on land at a level so low that no development is permitted. The theory is that the right to restrict development so completely must be acquired and paid for by the zoning agency if it is to withstand constitutional attack. In one leading case, a local

zoning ordinance restricted an existing private parking facility in a built-up downtown area so that it could only be used for parking purposes.[5] The effect of this restriction was to prohibit any development of the land, and to force the owner of the parking area to maintain it in an undeveloped state for the use of adjacent buildings. For this reason, the ordinance was held unconstitutional.

In this case of the private parking facility there were no reasons of public health and welfare that justified so restrictive a limitation on the use of the landowner's property. What if the purpose of a highly restrictive regulation of land use is to conserve and protect land which otherwise might be damaged environmentally? For example, land in a flood plain might be restricted from substantial development. Or property located in a wetland adjacent to a lake or stream might also be restricted to its existing undeveloped use to avoid any damage to the adjacent lake or stream from pollution or storm water run-off. Even in this situation, some courts have found the restriction unconstitutional, although the trend is now in the other direction.[6]

The question is whether the cases upholding environmentally restrictive land use regulations of this type would justify the restrictive application of the district emission quota in the example given above. In the flood plain and wetlands zoning cases, the courts were able to find that a restrictive land use regulation prohibiting all new development contributed to the protection of a critical natural resource. A restrictive wetlands control regulation, for example, will help protect ecologically sensitive wetlands in the area adjacent to the restricted property.

Just as in the wetland control situation, emission quotas attempt to restrict development in order to protect a common resource, the air rather than a water and water-related environment. There is, however, an important distinction between wetlands and flood plain restrictions and emission quotas. Under the wetlands and flood plain controls all of the land in a given area is totally restricted from development in order to protect the natural resource. Under emission quota strategies, new development is allowed until the quota is exhausted, and later development is denied in order to protect the air resource. To be comparable to wetlands and flood plain controls, emission quotas would have to restrict all development in a given area in order to implement the air pollution control objective. If the emission quota technique were used in the wetlands and flood plain examples cited above, a similar constitutional problem might arise. If some development were allowed in wetlands areas until pollution threatened, and if all development were thereafter prohibited, the owner whose land was restricted might also have a due process argument if the character of the surrounding development precluded any reasonable use of his land in its undeveloped state.

Superficially, due process objections are not as apparent under the emission density zoning technique. This technique does not permit the disapproval of a pollution source provided the owner of the source can acquire enough additional land to bring his pollution level under the quota. A similar compliance problem arises under the residential density controls contained in zoning ordinances. Enough land must be purchased by any would-be developer to bring his density within the allowable limits. The difference in the density control

situation is that the residential density policy is applied uniformly to all developers within the density control district, and does not vary with the nature of the residential development. Each unit of residential development requires the same amount of land. In emission density zoning, the emission limitation standard is uniformly applied, but the amount of land each source must own will vary with the emissions produced. Each unit of pollution requires the same amount of land, but the amount of land required by different polluters will not be proportionately related to the sizes of the sources. The question that arises is whether emission density zoning is vulnerable because the land assembly requirement is disproportionate to the size of the source even though it is proportionate to the amount of pollution the source emits. If emission density zoning is vulnerable on this ground, there is a risk that a court would find it unconstitutional on due process taking grounds if the amount of land required for any one source is excessively disproportionate to its size.

There is little direct legal precedent that can provide an answer to this question, although some guidance is furnished by the cases considering the constitutionality of official map restrictions and subdivision control dedications. An official map is a land use control through which a state or municipality can temporarily prohibit land from development in areas such as rights-of-way that are intended for future acquisition for highway purposes.[7] As in emission density zoning, the criteria for the application of the official map technique are uniform throughout the area in which it is applied, but the effect of the official map on different landowners will vary. In some instances, the official map may restrict an excessive amount of land

belonging to a single property owner. The courts have generally sustained official maps against an argument that the temporary restriction on development is unconstitutional as a taking. However, there is an undercurrent in the cases suggesting that an official map will be held unconstitutional as applied if an excessive amount of land belorging to one property owner is temporarily restricted from development by the offical map reservation.[8]

Subdivision control dedications are literally donations of land by subdivision developers to the community, to be used as sites for roadways, parks, and schools.[9] While the case law on subdivision dedications is not yet fully settled, the recent cases appear to have accepted subdivision dedications as constitutional whenever the purpose to which the dedicated land will be put meets a public service need generated by the subdivision.[10] Here, as in the official map cases, there is also some judicial indication that a subdivision dedication that is unduly burdensome to a particular developer will likewise be found unconstitutional.[11]

These official map and subdivision control cases dealing with excessive land reservation and dedication requirements may have equal protection as well as due process overtones. They nevertheless suggest that a land use control may serve some constitutionally acceptable community-wide purpose, such as air quality improvement or the protection of highway rights-of-way in advance of acquisition, but may nonetheless be held unconstitutional as applied if the burden it places on a single landowner is excessive. The difficulty of emission density zoning in this context is that the emerging test appears to be one of proportionality. Large emission sources will be able to

absorb the costs of additional land assembly without having to make a disproportionate expense, while the small but heavily polluting emission source will not. If a small factory with high levels of emissions is required to make a disproportionately excessive investment in additional land in order to comply with the emission density zoning requirement, the risk that emission density zoning will be found unconstitutionally burdensome as applied to that landowner is a possibility.[12]

Conclusions on the Legal Issues

The legal problems discussed in this section can be alleviated to some extent through appropriate administration of the emission quota system. As one possibility, only enough land could be zoned industrial in a given area to use up in full the quota that has been allocated. Under this approach, no last-come developer would be prohibited from development because there would be enough allocated emissions to allow all development up until the point at which the quota is exhausted. The trouble with this approach is that it is very difficult in advance to match emission allocations with zoning categories. Each new facility will have a different pollution potential.

Another way to avoid legal problems is through a conditional approval procedure which would amount to another variant of the emission quota strategy. No emission quota districts and no industrial or other similar local zoning districts would be designated in advance. Instead, new local zoning for industrial and other polluting facilities would be granted as new applications are made. When the emission quota is exhausted, the zoning agency could prohibit any new development. This approach could be incorporated into the floating zone emission quota procedure discussed above, and has respectable

precedent in the local floating zone procedures that have been adopted in many communities.[13] Again, however, if the conditional approval procedure results in the creation of an industrialized area in one section of the air pollution control region, and if new industrial development is prohibited in this area after the emissions quota is exhausted, constitutional questions similar to those already discussed would be presented.

On balance, the emission allocation planning procedure appears to present fewer legal problems than the other, more directive, emission quota strategies. Under EAP, each municipality is allowed to provide a mixture of land uses in its discretion, provided its EAP allocation is not violated. Through careful planning, situations can be avoided in which either equal protection or due process objections can be raised through the application of the EAP technique. Even under the EAP approach the municipality will have to be very careful to avoid the creation of a zoning and planning framework in which last-come developers will be prohibited from development because the EAP allocation has been exhausted. Prohibition of development because of quota exhaustion will always raise legal problems if the prohibition so restricts the land that no other reasonable use is possible.

NOTES

Reproduced from best available copy.

1. Krasnowiecki, Legal Aspects of Planned Unit Development in Theory and Practice, in Frontiers of Planned Unit Development 99, 104 (R. W. Burchell, ed., 1973).

2. But cf. DeMaria v. Enfield Planning & Zonning Comm'n., 159 Conn. 534, 271 A.2d 105 (1970).

3. The issues are extensively discussed in Potomac Institute, Inc., Local Growth Management Policy: A Legal Primer (1975).

   We should also note here that equal protection problems created by quota restrictions may also arise under other control strategies that have been adopted to implement the Clean Air Act. EPA's no significant deterioration rules place a quota on air pollution emitted by designated new stationary sources in Class I and Class II deterioration areas. See 39 Fed. Reg. 42510 (1974). Presumably, equal protection problems similar to those discussed here may arise in areas designated Class I or Class II by the no significant deterioration regulations. The problem is not likely to occur, however. Emission quotas are often applied to local industrial "hot spots" in which much industrial development has already occurred and in which any restriction on new industrial development appears arbitrary. Class I and Class II areas are likely to be areas in which little industrial development has taken place. The disapproval of a new stationary source in these areas is not likely to happen at a location already committed to industrial use. In addition, the states may always reclassify to Class III an area in which they wish to allow new growth.

   State implementation plans must also contain a procedure authorizing the denial of a new stationary source at any "location" at which it would violate a national ambient air quality standard. 42 U.S.C. Sec. 1857c-5 (1970). This provision would authorize the disapproval of a stationary source under circumstances that could raise equal protection and due process problems similar to those discussed in the text. Apparently the states have not yet used this provision to disapprove new sources solely on the basis of their location. If they did, the constitutional problems discussed in the text are again not likely to arise. The applicable standard under this provision is the air quality standard, so that a new stationary source may search the entire region for a location where a new plant will not violate the standards. However, if at some point the threat to air quality demands a total ban on any new industrial or other new stationary source throughout the region, the constitutional problems raised by emission quotas may arise. In this situation, however, any ban on new development is justified by the threat to the health standard for the entire region, and not by the exhaustion of a quota applied to a limited geographic area whose allocation depends explicitly on a priority of application. This distintion

may make a difference.

4. Development rights transfer techniques have been advanced as one method of dealing with this problem. See Baker, Development Rights Transfer and Landmarks Preservation--Providing a Sense of Orientation, 9 Urban Law Ann. 131. (1975).

5. Vernon Park Realty v. City of Mount Vernon, 307 N.Y. 493, 121 N.E. 2d 507 (1954).

6. The leading favorable case is Just v. Marinette County, 56 Wis. 2d 7, 201 N.W. 2d 761 (1972), noted, 86 Harv. L. Rev. 1582 (1973). See also Plater, The Takings Issue in a Natural Setting: Floodlines and the Police Power, 52 Tex. L. Rev. 201 (1974).

In Just, new residential development in a lake shore wetland was prohibited under the state's shoreline zoning act. The Wisconsin court held that the land could be regulated to maintain its "natural use" since any development of the property would disturb the ecology of the wetland area. Whatever the merit of the court's conceptual analysis, the effect of the ordinance upheld by the court is to restrict all development in the wetland area, as any development will be detrimental to the natural resource. As compared with wetlands regulation, emission quotas require an allocation strategy rather than total prohibition. New sources of pollution are allowed up to a threshold, and the question is how the emission allocation is to be awarded. The last-come polluter who is denied a permit for the development of his land can argue that no reason exists for the refusal other than quota exhaustion. Even though the reason for the restriction--to prevent air pollution--is appropriate, his argument is that his land cannot be fully deprived of all its development value for any public purpose unless compensation is paid. See the discussion in the text, infra.

It should be noted parenthetically that floodplain regulations may allow some development to occur so long as it is constructed to avoid danger from flooding. For example, in the outer area of the floodplain it may be possible to construct buildings on elevated platforms which will keep them over expected flood levels. This option may help protect the floodplain regulation from charges of unconstitutionality. See Vartelas v. Water Resources Comm'n, 146 Conn. 650, 153A.2d 822 (1959).

7. See Mandelker, Planning the Freeway: Interim Controls in Highway Projects, 1964 Duke L.J. 439 (1964).

8. A variance from the official map may be granted if the map is over-restrictive because it covers an excessive portion of the affected property. Rochester Business Institute Inc. v. City of Rochester, 25 App. Div. 2d 97, 267 N.Y.S. 2d 274 (1966). See Mandelker, supra note 7 , at 465.

9. See Note, Subdivision Land Dedication: Objectives and Objections, 27 Stanf. L. Rev. 419 (1975).

10. Just what next must be proved between the service need generated by the subdivision and the dedication or in-lieu money payment demanded from the developer has not yet been determined. For an expansive view of this requirement see Associated Home Builders of Greater East Bay, Inc. v. City of Walnut Creek, 4 Cal. 3rd 663, 484 P.2d 606, appeal dismissed, 404 U.S. 878 (1971).

11. See East Neck Estates, Lt. v. Luchsinger, 61 Misc. 2d 619, 305 N.Y.S. 2d 922 (Sup. Ct. 1969) (requirement of excessive amount of land for beach front dedication held unconstitutional). See also Zampierie v. Township of River Vale, 29 N.J. 599, 152 A.2d 28 (1959) (building setback line held unconstitutional as applied).

12. Additional Due Process taking issues may arise under emission quota strategies when the impact of other emission control techniques are considered in the context of the emission quota limit. Assume that a prospective developer will exceed his emission quota even though he will comply with all applicable new source performance standards. Suppose further that he can show that by using tall stacks, by switching fuel on meteorologically poor days, and by implementing other supplementary control techniques--all at his additional expense over and above the usual cost of source controls--he will not violate applicable air quality standards even though his emissions still exceed the quota. Now assume that unless the development can be built no reasonable use can be made of the land. Should the developer be given a variance? If no variance is given there may be a Due Process taking. If he is given a variance equal protection objections may be raised by smaller developers who cannot afford the same supplementary control techniques.

    The Equal Protection objections can be considered first. These objections have been dismissed in comparable situations when cost of compliance would arguably exclude developers unable to meet requirements of the regulations. Planned unit development ordinances are a case in point. Developers usually need to assemble comparatively large tracts of land in order to take advantage of these procedures because these ordinances usually apply only to development tracts of more than a minimum size. Courts have not found these ordinances objectionable even though the effect of the ordinance is to exclude the smaller developer who cannot assemble a tract that meets the minimum size requirement. They reason that the planned unit development process is open to all on the same terms. C. F. Chrinko v. South Brunswick Township Planning Bd., 77 N.J. Super 594, 187 A.2d 221 (L. 1963).

    Whether a developer subject to an emission quota should be given a variance under the circumstances described above depends on how the emission quota strategy is constructed. If the methodology used to determine the emission quota relates the quota to the attainment and maintenance of air quality standards then perhaps a variance can be given if it can be shown that the supplementary methods of control will not lead to a violation of that standard by the prospective developer even though the emission quota is exceeded. The acceptability of supplementary control techniques under the Clean Air Act has been questioned, however. NRDC v EPA, 489 F.2d 390 (5th Cir. 1974) (Georgia state implementation plan) .

    Another problem is raised if supplementary control techniques are allowed as the basis for a variance from the emission quota, since in this event operating permits will be required and these must be periodically reviewed to determine if the supplementary controls remain adequate to avoid air quality standard violations.

Presumably, it can be a condition of the variance that the supplementary controls be maintained and implemented during the life of the new source, with permanent or temporary shutdown of the facility as the remedy in case of noncompliance.

Whether emission quotas will have to recognize nonconforming sources also raises Due Process issues. Immediate retroactive elimination of nonconforming uses has not been allowed under zoning ordinances, but this principle may not apply in the air quality context because air quality regulations implement health standards. Local ordinances such as housing codes which impose health standards on nonconforming buildings have usually been applied retroactively. In the alternative, nonconforming sources may either be counted toward the permissible emission quota limit or gradually amortized out of existence over a reasonable period of time, a regulatory technique that has usually been upheld in the zoning context.

13. However, floating zone procedures have not been universally validated. See Haar & Hering, The Lower Gynedd Township Case: Too Flexible Zoning or an Inflexible Judicary?, 74 Harv. L. Rev. 1552 (1961).

CHAPTER FOUR

METHODOLOGICAL CONCERNS

Beyond the legal issues which surround the use of emission quota strategies are the methodological concerns over how these quota systems would be developed. One of the primary questions centers on how the numeric values of the quota would be established. It will be recalled that in the Jefferson County case an atmospheric dispersion model was run to determine the emission ceiling for the floating zones. Also, the emission allocation planning (EAP) proposal recommended in California suggested the use of a proportional model to determine an air basin emission ceiling.[1]

Depending on the kind of emission quota strategy used there are different approaches to determining the numeric values to be inserted. The most obvious relationship occurs between quota values and ambient air quality. Regardless of the particular emission quota strategy chosen, the numeric values inserted as quotas theoretically should produce air quality which meets federal ambient air quality standards. This implies, in turn, that atmospheric dispersion modeling, which takes meteorology into account, could be used to connect emissions generated within a quota system to an estimate of the air quality produced. Of course, as the California proposal indicated, proportional modeling, utilizing monitoring data and emissions generated, has also been considered a viable alternative.

The question of what numeric values to insert, however, is more complex than whether one uses an atmospheric dispersion or proportional model. In particular, it is important to determine the emissions gen-

eration framework within which quotas will be established. Consider, for example, how a municipality or county would be assigned a quota of a particular pollutant for a given year. Let us focus, then, on emission allocation planning and the development of quotas. There are two basic choices. The emission quotas can be allocated in terms of the existing land use configurations and emission characteristics. Or, the emissions can be allocated based on expected future development patterns. We shall examine these two alternatives, directing our attention initially to emission allocation planning.

Current Proportions Allocation

Following the work on EAP in California, a proportional model can be used to assign emission ceilings to jurisdictions. The jurisdictions would then be charged with shaping development to fit the pre-established quota. The difficulty here is that the original allocation to the jurisdiction would have to be based on some reasonable criterion. The California proposal used the criterion of extrapolating existing shares of region-wide emissions into future years. For example, if Hooverville had 10 percent of total sulfur oxide emissions in the base year, then the town could keep its share into future years regardless of the total regional amount of the pollutant. Clearly, this immutable fixing of a percentage penalized those jurisdictions at the metropolitan fringe which had little or no development in the base year.

To provide some flexibility in quotas variances could be granted to permit growth in formerly sparsely-developed jurisdictions. Variance procedures could be developed to handle the situations in which the freezing of emission quota percentages would not be in accordance with

equity considerations or sound regional development objectives.

Assuming that the choice would be made to follow the California example of extrapolating base year percentages into the future, a portion of the total allowable regional emissions could be reserved for variance situations. For example, 10 percent of total sulfur oxide emissions might be reserved for use by air pollution control officials in variances. In this way, the flexibility of the EAP process might avoid legal challenge. As discussed in the previous section, EAP may minimize legal problems exactly because of its discretionary nature.

However, it must also be recognized that, although the focus of this study is on maintenance, the attainment of ambient air quality standards is also at issue. In the California study, the proportional model developed was of a "rollback" variety. Air basin emissions in the base year were to be rolled back to the total allowable which met standards.

Assuming that attainment of standards meant a rollback of 20 percent, for example, in total sulfur oxide emissions, then a reserving of another 10 percent for potential variances would impose 30 percent total rollback on the region. This extra 10 percent would be an additional hardship. Depending on whether or not EAP would be utilized in situations where attainment of standards was necessary before long-term maintenance could be considered, this use of a variance reserve might be a viable option.

At this point, it is important to recall that the focus here is on the determination of how the numeric values are to be inserted into an emission quota strategy. The initial discussion has been of EAP,

and the determination of ceilings for jurisdictions within a region. The first strategy suggested the use of current base year emission proportions for jurisdictions and carried these figures forward to future years. A variance procedure could be instituted to provide flexibility in allocations to jurisdictions. Also, emission rights might be exchanged or sold among jurisdictions.

It is also possible to develop a current proportions analysis for district emission quotas and emission density zoning. The determination of quotas in EDZ would follow the preceding discussion about EAP: current district proportions of a fixed total would be carried forth into future years.

Emission density zoning would operate differently. In EDZ, the current proportions concept would mean that the future unit area emission quotas would be based on what exists currently, subject to air quality maintenance considerations. For example, if heavy industry contributes 40 percent of total sulfur dioxide emissions currently, then heavy industry would be allowed 40 percent of future allowable emissions. This 40 percent would then be converted to appropriate unit area emission quotas.

However, as will be seen in the next section, unit area emission quotas vary by the amount of land developed into polluting activities. If this 40 percent figure, say 1,000 tons, of the total allowable emissions is spread over 200 acres of heavy industry, then the unit area emission quota is 5 tons per acre per year. If, however, the 1,000 tons are spread over 500 acres, then the unit area quota is only 2 tons.

This example of a current proportions analysis indicates the

need in EDZ to consider the amount of development which will exist in the future. And in fact, current proportions analysis as a basis to developing emission quotas does not adequately handle the question of future activities and future sources. There is an alternative, the examination of future development.

Future Configurations Allocation

Rather than using current base year proportions of total regional emissions, allocations could also be based on future regional development configurations. The coherent growth and development of a region could be jeopardized by an EAP strategy which freezes development in terms of base year emissions. It seems appropriate to consider the dynamics of regional structure as an important element in air quality maintenance. Following this argument, projections of future regional development became the basis upon which emission quotas would be established. Current EPA publications on guidelines for air quality maintenance planning include discussions on projecting growth patterns into future years.[2]

Land use and transportation plans for the region provide one basis for determining future growth. While EAP has been discussed primarily thus far, the connections between land use planning and emission quota strategies also exist for emission density zoning and district emission quotas. In the discussion of emission density zoning in the guidelines series there is an analysis of the role of land use plans in developing the unit area emission rates.[3]

The connections between land use planning and air quality management have been examined in a number of recent publications.[4] Although different in emphases and format, the works in the area are all

basically concerned with the analysis of land use plans in terms of air quality objectives. In order to perform such an analysis, the planning data must be connected to emissions data through the aid of an emissions inventory. This emissions data is then fed into an atmospheric dispersion or proportional model, and the resulting data analyzed to determine whether the land use plan will violate air quality standards. Note that the evaluation of the air quality implications of a land use plan is based on the connections between planning data and emissions. As will be discussed subsequently, there are difficulties in estimating the amount of emissions from sources which do not yet exist. Before discussing the integration of land use planning and emission quota strategies into a coherent air quality maintenance strategy, it is important to understand the nature of earlier work in this area.

Earlier Work. As is discussed in a recent EPA publication,[5] there have been a number of research attempts at field testing various ramifications of the land use and air quality interface. Two of the research efforts are of particular interest, and important to the discussion here. Argonne National Laboratory[6] has done the greatest amount of empirical research on emission quota strategies. In particular, Argonne examined the air quality implications of emission density zoning. Argonne was interested in determining if emission density zoning would be potentially useful in controlling "hot spots," and in maintaining air quality within standards.

The conclusions which can be drawn from the work at Argonne are interesting. First, emission density zoning can act as an air quality maintenance strategy. By establishing appropriate emission rates

(e.g., tons/square mile/day), and including both currently developed land as well as land zoned by different categories, air quality can be maintained within standards. This assumes, of course, that there are no large-scale shifts in zoning such that formerly low emission areas become populated with heavy polluters. Simply, large low-density residential areas could not be re-zoned as a heavy industrial section without re-evaluating the emission rates.

Second, experimental work indicated that air quality standards could be met by using emission density zoning in place of point source regulations. Argonne, by estimating the amount of reduction in pollutants emitted from the uncontrolled situation, compared the two different strategies. By attaching an economic cost to the point source regulations and the emission density zoning strategies, an analysis could be made in terms of dollars. Argonne concludes that although the amount of control cost through the two strategies vary by SIC, this variation is not significant. Basically, according to their calculations and their analytic framework, there are relatively minor differences between the economic cost of point source regulations and emission density zoning procedures.

Third, the Argonne research clearly points out the difficulty of using two-digit, and even four-digit, SIC codes as a basis to estimating emissions generated from industrial sources. There are simply too many different kinds of industrial plants and processes involved at both the two-digit and four-digit levels to allow the use of the SIC system in predicting emissions. The variance about mean estimates of pollutant emissions by two-digit SIC code is extremely high in many cases.

The difficulty, then, centers on what kind of planning variables could be used to estimate emissions from future sources. Planners often have some sense of expected industrial development, and may be able to project with some accuracy the SIC codes for future industries. However, Argonne argues that knowledge of SIC codes may not provide a reasonable basis for estimating emissions.

Environmental Research and Technology, Inc., (ERT) has also puzzled over the land use and air quality interface question. ERT[7] was given a contract to determine the air quality impacts of four land use plans for the Hackensack Meadowlands in New Jersey. ERT developed the Air Quality for Urban and Industrial Planning (AQUIP) system which used land use data directly as a basis for projecting emissions. For illustration purposes, ERT developed a set of emission factors related directly to land use categories.[8] For example, under certain fuel assumptions, ten dwelling units per acre would generate twenty-five pounds of total suspended particulates per year. Also, on acre of heavy manufacturing would generate five thousand four hundred pounds of total suspended particulates per year. These figures are illustrative only, but suggest the kind of framework within which ERT was working. They recognized, as did Argonne, that there are wide variations in the amount of emissions by industrial plants and processes even within such detailed levels of information as four-digit SIC codes.

Both Argonne and ERT were concerned with land use and air quality. Both were very clearly concerned with the serious problems of estimating emissions from any future land use data. They differ primarily in terms of general approach. Argonne focused on industrial

growth and change and evaluated two alternative strategies, point source regulations and emission density zoning. ERT, on the other hand, attempted to systematically relate land use planning to air quality estimates. Both provided large amounts of information which to this day represent important contributions to understanding the connections between land use planning and air quality management.

Land Use Planning. The emission quotas assigned to jurisdictions in EAP could be a direct product of a regional land use and transportation development plan. By connecting up planning data with emissions generation data, the viability of a regional plan could be tested. In such a framework, the focus would be on average annual, or possibly seasonal, pollutant concentrations.

It must be remembered that there are trade-offs between technology, in the form of stationary and mobile source performance standards, and the nature and quantity of land use and transportation activities. The simplest situation, then, would be one where the set of land use and transportation configurations which violate long-term air quality standards, under certain technological assumptions, were determined. The task of the policy-makers, planners and air pollution control specialists would be to avoid these land use and transportation configurations, or if reasonable, change the technological parameters.

This first method of maintaining air quality basically makes the metropolitan area a laboratory where unacceptable configurations of land use and transportation activities are discarded. In more general terms, what is being developed is an "envelope" of possible likely futures within which air quality is maintained. Alternate

futures could be developed within the envelope and evaluated by decision-makers. From such analysis, a range of potential emission quotas could be developed for a jurisdiction in EAP and a set of emission rates developed for a land use class in EDZ.

The process by which emissions could be estimated from land use plans will be described in a succeeding section. At this point, it is important to understand only that alternative land use configurations will mean alternative emissions generation and dispersion. Through dispersion modeling, ambient air quality concentrations can be projected. The quotas then act as "lids" within which emissions generation takes place. The envelope of likely futures, then, would provide a negotiation platform within which emission quotas could be established by jurisdictions in EAP, or set among different land uses in EDZ.

However, the development of an envelope of possible likely futures is unrealistic. Most planners and air pollution control specialists will simply not have the resources available to undertake such a large task. At best, information might be developed which would indicate the future air quality impacts of a limited number of alternative regional land use patterns. It is possible to perform air quality analyses of a selected set of land use plans for a region. Middlesex County, New Jersey has done an air quality study to 1985 and 2000 for two different land use plans.[9] ERT, in the Hackensack Meadowlands project,[10] among others, has also done such studies.

The second use of land use plans in emission quota development, then, involves the more limited objective of using selected land use plans in the development of emission quotas. In spite of the

apparent complexities involved in estimating future air quality as an element in air quality maintenance, experience has shown that certain well-defined studies can be done. Most planners know the local area well enough to make reasonably informed judgements as to what kinds or magnitudes of growth will occur in the future. Usually, they have inventoried land use, population and employment, and are often basing judgements of future development on past local experience and expected regional trends. Clearly, the planner cannot predict the future with any certainty. However, when it is realized that, in many metropolitan areas, the already-existing physical, social and economic structure is not going to change much in the foreseeable future, then this difficulty in predicting changes is not as important as might be thought.

Local air pollution control specialists also know a great deal about the nature and extent of polluting sources and the type of control programs which will be implemented. What is needed is a process by which the information from the various knowledgeable sources can be systematized within a common framework. In the Middlesex County study, a technical advisory board was created including individuals from local and state air pollution control agencies, public utilities, the regional planning commission and local environmental groups. The information gleaned from this advisory board was invaluable, exactly because communication was established among individuals and groups who singularly have a great deal of knowledge in different, sometimes overlapping areas. The question then becomes: how do you take the available knowledge from the local area and develop a set of emission quotas which is based on desirable future land use configurations as represented in a regional development plan?

Integrating Land Use Planning and Emission Quotas

The four emission quota strategies form a simple typology by spatial level. As seen below, the name of the strategy generally

Strategy	Spatial Definition
Emission allocation planning (EAP)	Political jurisdiction: metropolitan area, county, municipality
District emission quotas (DEQ)	Zoning or planning districts
Floating zone emission quotas (FZEQ)	Areas drawn about point source
Emission density zoning (EDZ)	Unit areas: acre, square kilometer or mile

relates directly to the spatial unit for which the emission quota is developed. All the strategies are conceptually simple variations of an emissions limitation framework. However, even these basic air quality maintenance strategies raise interesting methodological questions when related to land use planning. The four emission quota strategies can all be placed within a common methodological framework. This common core of methodological considerations, however, must be thought of as a framework within which each technique is viewed, and not as a prescribed way of proceeding. Basically, there are six areas of importance:

1. The development of an accurate emission inventory and the collection of monitoring data.
2. The selection of the future land use and transportation configurations which will be analyzed.
3. The development of emission factors to be used with land use and transportation data.
4. The calculation of future emissions from the land use and transportation configurations.
5. The determination of whether a particular land use and transportation configuration will maintain air quality standards, through a proportional or dispersion model.

6. The development of policy and programs, including emission quotas, which reflect the findings of the investigation, including the possible testing of altered land use and transportation systems.

The six steps outlined above are a straightforward extension of the current work in the area.[11] In order to more fully understand the connection between emission quota strategies and land use planning we will discuss the emissions inventory, future land use and transportation configurations, and the development of emission factors in more detail.

The Emissions Inventory. The development of an accurate emissions inventory is essential for a number of reasons. First, it operates as a base point from which future air quality projections are made. The high level of uncertainty about future land development and transportation system patterns, accompanied by potentially highly inaccurate emission estimations, give the inventory a very influential role in air quality maintenance. The projection of emissions generated at some future year is tautologically the summation of current emissions and changes in emission levels between the current and future years. If, as has been suggested, the estimation of changes in emission levels between present and future years is highly error-prone, then the accuracy of current emission estimates becomes even more important. The process by which emission levels are projected to future years will be discussed in the section which follows. The important point here is to realize that sufficient resources must be expended on the emission inventory to ensure that it adequately reflects the pattern of pollution generation within the region. It has been suggested by Hilst[12] that emission inventories are systematically biased because

some number of sources are always missed, but rarely, if ever, are sources double counted.

Beyond the emission inventory operating as a base upon which future emissions are projected, the inventory serves a second purpose -- a data source for the calculation of land use related emission factors. For example, the projection of emissions from future industrial activity may be conceived of in terms of an emission per employee ratio.[13] The emission per employee ratio may be totally, or only partially, derived from the particular emission inventory data for the study area. The inventory would provide information on the amount of pollutants generated, and surveys of the firms could be used to ascertain current employees. These ratios, constructed on local data, could provide a basis for projecting future emissions, assuming that economic activity projections of future employment by industry type are available. Obviously, one could also use information collected on emission levels and employee numbers from other study areas to supplement local data.

Future Land Use and Transportation Configurations. Air quality maintenance strategies, including emission quotas, implies a concern about the future. A ten year air quality maintenance plan implies knowledge of emissions which will be generated by yet-to-exist metropolitan configurations. The EPA work in air quality maintenance planning does contain procedures for projecting aggregate regional growth patterns and allocating this growth to sub-areas.[14] However, in most instances these procedures will not yield all the land use and transportation projections needed for the development of emission quotas at the municipality level, required in EAP, or by unit area, as in EDZ.

The development of future land use and transportation data as a base to emission projections will often require direct involvement of urban and regional planners. It is particularly important that the need for a reasonable estimate of future land use and transportation activity be available. However, there is a basic distinction which should be kept in mind in projecting emissions from such land use and transportation system activity.

This distinction is between planned requirements and computer simulation approaches to developing future land use plans. The planned requirements approach describes traditional land use planning methodology, best detailed in Chapin.[15] Population and employment forecasts are developed. Aggregate amounts of different land use categories needed to accomodate the population and employment forecasts are estimated. For example, an expected growth of 25,000 new residents and 10,000 new jobs will create the need for additonal amounts of land use devoted to residential, commercial, institutional, and industrial activities. These aggregate amounts of different land use categories must then be allocated to specific geographic locations within the study area by an intuitive process based on the consideration of locational criteria specific to the various land use categories. For example, of an estimated need for 100 new acres of commercial activity a planner might decide that 20 acres would go to a particular census tract or planning district based on access, sales potential and the availability of vacant land in an appropriate zoning category. Obviously, there are other locational considerations which might have been considered, but a fundamental fact emerges whatever set of criteria are used: the land use pattern developed is, at best, a reasonable

approximation of what might happen.

Traditionally, comprehensive land use plans have been produced through a planned requirements approach. These land use plans are normative documents, outlining what should happen. The recognition that these land use plans would be little more than pieces of paper without some attempt at shaping urban growth has led to the creation of the "urban development guidance system" approach.[16] Such an approach would utilize instruments like zoning, subdivision regulations, and the location of highways and sewers within an integrated framework to shape urban development.

The use of emission quota strategies for air quality management depends on the linkages between future land use and transportation system development and the quantity of pollutants emitted. The planned requirements approach for developing future land use plans, coupled to programmatic attempts at carrying out the plan through the use of such concepts as the urban development guidance system approach, can at best present a fuzzy image of future development. There is simply too much complexity in non-deterministic urban systems to predict accurately.

The realization by planners of the complexity of urban processes, particularly in larger metropolitan areas, led to the development of computerized simulation models. These computer simulation models predicted future urban development patterns by encapsulating elements and connections between elements from the real world.[17] The models developed during the past two decades vary widely in their attempts at simulating reality and in their mathematical structure. However, these models all share the common failing that they have not become

integrated into the decision-making processes of the great majority of land use planning agencies.

It has been argued that one can view computer simulation models as a logical extension of the planned requirements approach by systematizing the intuitive processes in locating new land use activities which are found in the planned requirements approach.[18] This view, whatever its merits, has not been sufficiently persuasive in convincing many planning agencies to actively seek to develop simulation models as a more systematic alternative to the planned requirements approach. From the point of view of air quality management, emission quota strategies require reasonable projections of future land use and transportation patterns. At this time, these projections will generally be based on a planned requirements approach.

The Development of Emission Factors. Emission factors are the linkages between measures of land use and transportation activities and the amount of pollutants generated. Basically, the total amount of pollutants emitted by a stationary or mobile source is a joint function of the number of units of the activity and the amount of emissions per unit of activity. This can be stated as follows;

$$E_i = A_i * F_i$$

where:

E_i : Total amount of a pollutant emitted by a source i during some time period

A_i : Numbers of units of the ith activity comprising the source

F_i : The amount of emissions, or emission factor, for each unit of the ith activity during the time period

This simple multiplicative equation encompasses a wide range of analytic procedures by which emissions can be estimated from a source.

For purposes here, it will only be important to sketch out the range of options available for estimating emissions as a base to understanding the potential utilization of the various emission quota strategies.

There are a number of different approaches to estimating emissions from future land use and transportation configurations. The general approaches can be classified into the following:

1. Direct employment of land use data in estimating emissions
2. Use of process and space-heating data for industrial, commercial, residential, and institutional activities
3. Use of surrogate planning data, such as employment and population projections

In the following discussion, the focus will be on the estimation of process emissions from industrial sources. Projection of space-heating emissions from residential, commercial and institutional activities is not as difficult as emissions from industrial processes.[19]

First, the land use and transportation data can be utilized directly. For example, Environmental Research and Technology, Inc., developed a set of emission factors which related land use directly to emissions. As an illustration, it was estimated that one acre of light manufacturing would generate 1,100 pounds of sulfur dioxide per year.[20] A simple conversion could then be made from projected land use acreage to emissions.

Obviously, there is a host of assumptions required to relate land area directly to emissions. These include such items as the type and size of structure which is on the lot as well as the kind of activity being carried out. A basic review of the literature on air pollutant emission factors will quickly show that the most widely-known approach to estimating emissions from industrial sources

utilizes the level of industrial activity in the establishment.[21] For example, a secondary aluminum operations plant, making lightweight metal alloys for industrial castings, is estimated to emit 14.5 pounds of particulates per ton of output in the sweating furnace when the process is uncontrolled. The use of a "baghouse" will reduce the emissions to 3.3 pounds per ton.[22]

The second technique, then, for estimating emissions from future sources involves knowledge of industrial processes. Although the air pollution emission factors based on industrial activity are very useful in estimating pollutants generated from existing sources, they are less useful in estimating emissions from projected sources. There are two reasons why future industrial emissions are difficult to project. First, as suggested earlier, projections of the location of polluting land uses is an uncertain proposition. Since emissions vary widely by type of industrial process involved, it is important to determine the location of future industrial activity accurately by type.

Second, even given a relatively accurate industrial location projection methodology, it is not clear that emissions can be satisfactorily determined. For example, as noted earlier, work at Argonne National Laboratory indicated that using two-digit, or even four-digit, Standard Industrial Classification system (SIC) codes does not ensure that emissions will be accurately estimated.

Hence, the estimation of future emissions through the determination of the kinds and levels of industrial activity projected to occur is not usually a viable approach. It is difficult to determine where different types of future industrial activity will occur. Even if one

could accurately ascertain the location and nature of future industries, existing work suggests that there are serious inaccuracies in estimating emissions from similar industrial plants and processes. Since there are potentially serious errors in the use of industrial activity emission factors, it makes sense to consider an alternative method.

The third method which will be discussed is the use of surrogate planning variables. Basically, these include employment and population data. Thus, an emission per employee ratio can be developed which utilizes future employment projections. This technique was employed in Middlesex County, New Jersey.

In a study performed jointly by the Middlesex County Planning Board and an environmental consultant, air quality estimates were obtained for 1985 and 2000 for particulates and sulfur dioxide.[23] The planning board staff had developed land use plans for these two years. These plans were sufficiently detailed, including employment, land use and transportation data for 89 analysis areas within the study area.[24] The current (1972) emissions were estimated from an existing inventory. Emissions from industrial growth between 1972 and the years of 1985 and 2000 were estimated from surveys and planning information. The major polluters in the study area were interviewed to ascertain plans for expansion and to determine future pollution abatement plans. Finally, emission per employee ratios, derived from analysis of local industries, were used to develop emissions from projected industries. The study recognized the varying pollutant characteristics of different industrial classes. Separate employee projections, and emission per employee calculations, were

done in each analysis area for the following S.I.C. categories: chemicals (28); petroleum (29); primary metals (33); power plants (49); and all others.

To summarize the approach developed in Middlesex County, a three-fold strategy was developed to estimate future emissions. First, current emissions from existing sources were derived from an emissions inventory. Second, future emissions from existing sources were estimated by surveys of expansion plans and pollution abatement intentions. Local air pollution control officials provided important information. Third, future emissions from non-existing sources were derived using emission per employee ratios and projections of future employment.

The Middlesex County study is a model of what can be done in estimating emissions from land use and transportation planning data. The projected emissions of particulates and sulfur dioxide were entered into an atmospheric dispersion model, and ambient air concentrations calculated for 1985 and 2000 for two different land use plans. The study indicated that high concentrations, exceeding federal standards, could be expected in future years in Middlesex County. From such analyses, emission quotas could be developed to ensure that future air quality would be maintained within federal standards.

The U.S. Environmental Protection Agency has published two documents that substantially aid in the process of developing emission factors and in calculating emissions from land use and transportation configurations. Volume 7, Projecting County Emissions, of the Guidelines for Air Quality Maintenance Planning and Analysis presents techniques for projecting emissions for each county located within an air quality maintenance

area at five-year intervals. Volume 13, Allocating Projected Emissions to Sub-County Areas presents a set of techniques for determining emissions from municipalities, census tracts, and planning districts within a county. The report sets out a framework for determining emissions from residential, transportation, commercial, institutional, industrial, solid waste disposal, and other miscellaneous sources. It is an important basis reference document for any agency faced with the problem of determining sub-county emissions.

It is important at this point to differentiate between the various emission quota strategies in terms of their use of emission factors. If emission quotas were assigned to jurisdictions based on analyses such as carried out in Middlesex County, then EAP becomes a straightforward extension of the interaction between land use planning and air quality maintenance.

Should the original land use plan prove unacceptable because of the projected ambient air pollutant concentrations, then the plan can be re-designed. The revised emissions generation data resulting could be fed into the dispersion model again. When an acceptable plan, in terms of air quality and other dimensions such as economic viability and political feasibility, is found, the plan then becomes the basis upon which emission quotas are developed for each jurisdiction.

In EAP, then, the emission factors are developed using the three general approaches outlined at the beginning of this section. District and floating zone emission quotas could be derived in a similar fashion.

Emission density zoning, however, presents a different type of problem. The emission factors for projected development would actually be the proposed emission quotas per unit area.[25] Thus, if the quota were 2 tons of particulates per acre of lot size per year for heavy industry, this 2 ton quota would be inserted as an emission factor. It would be important, then, to know the amount and location of the projected acreage of the various land use categories controlled by EDZ regulations.

Future air quality would be estimated utilizing the selected EDZ emission quotas for new sources, the emissions inventory for existing sources, and ambient background concentrations. The emissions generated would be fed into a dispersion model, following the process outlined above. Should projected ambient air pollutant concentrations exceed federal standards, then the emission quotas in the EDZ strategy would have to be altered.

There is an essential point here which must be clearly understood. Assuming an average fixed assimilative capacity within the region over the long run, then the unit area emission quotas in an EDZ strategy will vary with the amount of projected development.

Empirical work at Argonne National Laboratory demonstrates the connection between EDZ emission rates and the amount of area under development by a particular class of polluters.[26] Using Chicago as a study area, particulate concentrations were estimated through an atmospheric dispersion model for two different situations. First, all current land use in heavy and light industrial categories was placed within an EDZ unit area quota. The optimum emission rates were 3.3 tons per day per square mile for heavy industry, and .85 tons

for light industry. When the analysis was run for land currently zoned for heavy and light industry, the emission rates dropped to 2.5 tons and .55 tons. Note that in both cases federal air quality standards operated as an upper boundary: ambient concentrations were kept within the standards. The particular emission rates chosen were selected from an infinite set of alternatives based on minimizing the annualized cost incurred by existing sources for the purchase of pollutant control devices necessary to meet the unit area emission rates.

The emission rates were reduced by 24 percent for heavy industry and 35 percent for light industry when currently zoned land was used rather than current land use. This connection between unit area emission quotas and the amount of land in development shows the difficulty of basing EDZ quotas on the maintenance of projected ambient air concentrations within federal standards. As the amount of development varies so also the emission rates can vary. Emission density zoning faces the difficulty that there is a large degree of uncertainty in any projection of a metropolitan development pattern for a given year. Even more, the metropolitan area changes over time. Developing unit area emission quotas for particular land use and transportation plans means that deviations from the plan may result in ambient air quality standards not being maintained. It may not be realistic to base EDZ unit area quotas on a fixed development pattern, unless one were to argue that these rates could be altered in the future.[27]

Of course, there may be a way of avoiding the direct connection between the unit area emission quotas and the amounts of developed

land. Unit area quotas could be assigned without regard to type of land use, and a market could be established for the exchange of emission rights among land owners. Alternatively, unit area quotas assigned according to type of land use could vary according to the location of that land use. Another possibility is to assign the quotas according to type of land use, but base the quotas on anticipated ability of land owners to comply, rather than on the need to maintain air quality standards. The possibilities are many. Although this report is written with the implied assumption that EDZ must be tied to traditional land use zoning in order to be effective, this need not be the case. Some communities, particularly those with ineffectual land use zoning, may wish to sidestep the problems inherent in maintaining unit area quotas while still granting variances, rezonings, and special use permits under land use zoning regulations.

In summary, the emission factors attached to projected development are essential elements in determining the viability of air quality maintenance objectives in future years. In EAP and district and floating zero emission quotas, the emission factors used may be derived directly from land use data, from process and space-heating information, and from surrogate data such as employment projections. In emission density zoning, the unit area emission quotas are the emission factors for new sources.

Source Configurations

In the examination of emission quota strategies the focus has centered on their use in controlling stationary sources. There are a number of issues which should be examined given this stationary source orientation. First, what can be said at this time about the connection

between stack height regulations and emission quotas? Second, how would the location of a stack within a parcel affect emission quotas? Finally, under what conditions could mobile and indirect sources be treated within an emissions quota framework?

Stack Height. Other than the use of stack height requirements in the Cook County EDZ regulations[28] there has been little discussion of the topic. Since tall stacks can reduce pollutant concentrations in the vicinity of the source, EDZ regulations could contain quotas which vary with the height of the stack. This assumes, however, the sources are isolated enough that the tall stacks which distribute pollutants over a larger area, are not increasing concentrations excessively at distant points removed from the source.[29] Since air quality maintenance areas typically are in highly-polluted metropolitan locations it is not clear that tall stacks should be allowed to pollute more per unit area than short stacks. Clearly, there are complex micrometeorological effects which might argue for a connection between EDZ regulations and stack heights, but this would be a case-by-case decision and not a general rule.

A similar argument holds for floating zone and district emission quotas. Only if the sources are isolated should the FZEQ or DEQ ceilings take stack height into consideration. Emission allocation planning, as a more broadly drawn tool, is not directly connected to stack height regulation except in terms of two administrative issues. First, are tall stacks from other regions upwind causing high background concentrations? Second, should emission ceilings be raised in jurisdictions where tall stacks are being used?

Stack Location. The location of the stack on the lot is of concern for two reasons. First, a heavy polluter can cause high ground level concentrations near the source depending on meteorological conditions. Second, land use based emission factors, and in particler unit area emission quotas, often view polluters as area sources. On the first issue, it is not clear exactly how the site location of the stack can be handled in some of the emission quota strategies, such as EDZ and EAP. In EDZ the emission ceiling is set for the particular size of lot chosen, and does not vary by location of the stack. It does not seem reasonable to develop a connection between the emission ceiling and stack location without some logical basis. The clearest rationale for concern with stack location would be the avoidance of high pollutant concentrations in sensitive areas. Fugitive emissions are also important. These are emissions that escape to the atmosphere through windows, doors, vents, etc., but not through a primary exhaust system, such as a stack, flue, or control system. Fugitive emission often have a greater effect on air quality in the immediate vicinity of a source than do stack emissions. Thus, stack location probably should not be considered in setting emission ceilings.

Floating zone emission quotas, however, may be another matter. Since the zone is circumscribed around the source, it would be quite easy to place the center of the zone at the primary stack location. Although again there is no direct connection between stack location and ambient pollutant concentrations, the FZEQ is at least partially sensitive to the placement of the stack on the lot. As the center of the floating zone shifts the total amounts of emissions within the zone will vary.

The second issue regarding stack location centers on the use of area source emission rates to replicate future point sources. For example, in the determination of EDZ emission rates future development is simulated as area sources, emitting, for example, 5 tons per acre over the entire lot. Clearly, large point sources will not emit exactly as area sources. The question, not answerable here, is how much distortion could one expect by substituting area for point sources, particularly where these point sources are located at one extreme end of the lot? There are examples in simulating future development where area sources have been substituted for point sources.[30] In the situation where one is already dealing with crude data inputs and expects crude output this decision is perfectly reasonable.

Mobile and Indirect Sources. As discussed earlier, emission quota strategies have been analyzed in this study in terms of stationary source applicability. The question now centers on the use of emission quotas for mobile sources and pollution-inducing indirect sources. It is clearly possible to use emission quotas for mobile sources, although the framework of analysis differs considerably from stationary sources.

Two emission quota devices, emission allocation planning and district emission quotas, can be used. Emission allocation planning is more amenable to oxidant control because both are regional in effect. Basically, emission ceilings would be placed on jurisdictions in terms of the formation of hydrocarbon precursors of oxidants. In all likelihood, until adequate models of oxidant formulation and transport are developed a proportional model framework would be used to compare concentrations--current monitored data and federal limits--with region-wide emissions--current levels and proposed ceilings.

The EAP quotas could then become a component of any transportation control plan developed for the region. The determination of the ceilings for the different jurisdictions would follow the current proportions allocation methodology outlined earlier. Given the development of an adequate oxidant dispersion model there is the potential of using future configurations allocation based on a regional development plan.

The purpose of using EAP for mobile sources would depend on the allocation process utilized. Under a current proportions allocation, EAP could ensure that jurisdictions each would be given a fixed share of total emissions and, under a roll-back, a fixed share of required regional emission reductions. This fixed share would distribute the emission reductions on an equal percentage basis, thus equalizing the impacts. Under a future configurations allocation, the EAP limits could be used to foster a regional development plan. In controlling emissions levels we are, of course, indirectly controlling vehicle-miles traveled.

The use of district emission quotas would be directed at localized concentrations of carbon monoxide (CO). A central business district (CBD) could be treated under a DEQ strategy. A proportional model, relating current CBD monitored CO concentrations and federal standards to current and allowable emissions, could be used.[31] Although crude, such a method could provide rough estimates of needed emission reductions for attainment of standards or the emission ceilings for maintenance.

Indirect sources, those pollution-inducing land use activities such as shopping centers and stadiums, are handled under an emission quota framework in a fashion similar to mobile sources. On the regional

level, EAP provides a framework within which indirect sources can be evaluated. Attached to the development of an indirect source are the emissions from the land use activity as well as emissions from induced mobile sources. Emission allocation planning can encompass a vector of pollutants, establishing jurisdictional ceilings across the entire vector. In its broadest context, EAP would contain quotas for a range of pollutants under federal control, such as particulates, sulfur oxides, hydrocarbons and carbon monoxide. Indirect sources could then be evaluated in terms of their contributions to the full range of pollutant totals for the jurisdiction. This use of EAP could supplant any indirect source regulations existing at the time,[32] providing a larger regional perspective.

It may also be possible to use district emission quotas in areas where indirect sources will locate. By placing localized concentrations of carbon monoxide within a DEQ ceiling indirect source emissions can be evaluated. This use of DEQ for indirect sources is not a recommended approach at this time. The connections between the use of DEQ and current indirect source regulations require careful analysis beyond the scope of this study.

Conclusion

This chapter on the methodological aspects of emission quota strategies has examined alternative methods for determining the numeric values to be inserted into the various emission ceilings. There is the particular issue which must be faced regarding the choice of a regional development pattern. Do we extrapolate emission ceilings from current situations or from future expectations?

In the next chapter we will analyze the prospects and problems with emission quota strategies. We should keep in mind the discussions above about the similarities and differences of the four different strategies with regard to the development of numeric estimates of quotas.

NOTES

1. Livingston and Blayney, Report on Guidelines for Relating Air Pollution Control to Land Use and Transportation Planning in the State of California (1973).

2. See United States Environmental Protection Agency, Guidelines for Air Quality Maintenance Planning and Analysis, Vol. 2: Plan Preparation, Vol. 4: Land Use and Transportation Considerations, Vol. 5: Case Studies in Plan Development, Vol.13: Allocating Projected Emissions to Sub-County Areas (1974) [Hereinafter cited as Guidelines, Vol. 2,4,5 or 13].

3. Guidelines, Vol. 3, II-29 to II-35.

4. See Guidelines, Vol. 4; A.M. Voorhees and Associates, Inc., A Guide for Reducing Air Pollution through Urban Planning (1971); and A.H. Epstein, et al., A Guide for Considering Air Quality in Urban Planning (1974).

5. Guidelines, Vol. 4.

6. A.S. Kennedy, et al., Air Pollution/Land-Use Planning Project, Phase II Final Report (1973) [Hereinafter cited as Kennedy].

7. Environmental Research and Technology, Inc., Hackensack Meadowlands Air Pollution Study (1972) [Hereinafter cited as Environmental Research and Technology, Inc.].

8. Guidelines, Vol. 4, 58 to 61 and B-1 to B-7; and B.H. Willis and J.R. Mahoney, Planning for Air Quality, paper presented at the annual meeting of the Amer. Inst. of Planners (November 1972).

9. TRW, Inc. and Middlesex County Planning Board, Air Quality Management and Program Recommendations (1974) [Hereinafter cited as TRW, Inc. and Middlesex County Planning Board].

10. Environmental Research and Technology, Inc.

11. See Guidelines, Vol. 4, 59, and J.J. Roberts, E.J. Croke, and S. Booras, A Critical Review of the Effect of Air Pollution Control Regulations on Land Use Planning, 25 J. Air Pollution Control Ass'n 500 (1975).

12. G.R. Hilst, Sensitivities of Air Quality Prediction to Errors and Uncertainties in Proceedings of Symposium on Multiple-Source Urban Diffusion Models (A.C. Stern, ed., 1970).

13. TRW, Inc. and Middlesex County Planning Board; and Guidelines, Vol. 13, 87 to 115.

14. Guidelines, Vol. 2 and 13.

15. F.S. Chapin, Jr., Urban Land Use Planning (1965).

16. See E.J. Kaiser, et al., Promoting Environmental Quality through Urban Planning and Controls (1973) and G. Hagevik, D. Mandelker, and R. Brail, The Contribution of Urban Planning to Air Quality, 7-6 to 7-13 (1974) [Hereinafter cited as Hagevik, Mandelker, and Brail].

17. For an overview, see H.J. Brown, et al., Empirical Models of Urban Land Use: Suggestions on Research Objectives and Organization (1972) and D.A. Krueckeberg and A. Silvers, Urban Planning Analysis: Methods and Models, Chpts. 9 and 10 (1974). [Hereinafter cited as Krueckeberg and Silvers]. For a basic discussion of the relationship of land use and transportation models to air quality see R.K. Brail, Modeling the Interface between Land Use, Transportation and Air Pollution in The Relationship of Land Use and Transportation Planning to Air Quality Management (G. Hagevik, ed., 1972)

18. Krueckeberg and Silvers, Chapter 9.

19. See the discussion in Hagevik, Mandelker, and Brail, Chpt. 7.

20. Hagevik, Mandelker, and Brail, 7-20.

21. Hagevik, Mandelker and Brail, 7-21 to 7-25.

22. U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, (Pub. No. AP-42, 1972).

23. TRW, Inc. and Middlesex County Planning Board.

24. The study area consisted of all of Middlesex County and Franklin Township in adjacent Somerset County.

25. See Guidelines, Vol. 3, II-29 to II-35.

26. Kennedy, Vol. 3, 18 to 29.

27. Guidelines, Vol. 3, II-35.

28. Kennedy, Vol. 3,19 to 21.

29. Guidelines, Vol. 3, III-51.

30. TRW, Inc. and Middlesex County Planning Board;and Kennedy, Vol. 3.

31. TRW, Inc. and Middlesex County Planning Board, Chpt. 2.

32. See Comment, Control of Complex Emission Sources - A Step Toward Land Use Planning, 4 Ecology L.Q. 693 (1975).

CHAPTER FIVE

THE FUTURE USE OF EMISSION QUOTA STRATEGIES

Problems and Prospects

In general, emission quota strategies hold promise as a technique for advancing air pollution objectives. However, this study indicates that emission limitation techniques present some serious problems in adoption and implementation. Let us briefly indicate some general objections to emission quota strategies as currently developed. First, emission quota strategies deal best with non-reactive pollutants from stationary sources, such as particulates and sulfur dioxide. Although the last chapter indicates that mobile and indirect sources might be encompassed within emission quota strategies, particularly EAP and DEQ, more work needs to be done to integrate these vehicular-related pollution sources with emission quota strategies. This problem is an important one, since location decisions about stationary sources of industrial pollution which are made within an emission quota strategy will necessarily affect the location of indirect sources, such as commercial establishments and large apartment developments.

Second, the emission quota technique may require an extremely controlled type of regulation which may be difficult to implement. Because of the legal problems created, air pollution control and zoning agencies may not be able to implement emission quotas on a self-regulating first-come basis. However, the adoption and enforcement of stringent emission quota controls that attempt to match the emission quota in advance with specific types of land use are very difficult to

implement. Stringent controls of this type may lead to serious distrubances in the local land market because the controlling agencies simply cannot force the right facility with the proper emission level to appear in the right area, at the right place, at the right time. Of the four emission quota strategies, emission allocation planning appears the easiest to implement, affords the most flexibility, and raises fewer legal issues than the other strategies that have been discussed.

At the same time, EAP is such a generalized approach that it is not clear that direct enforcement of the ceilings would be feasible. The California experience, as summarized in Chapter Two, indicates the difficulty which EAP has had in that state. Emission allocation planning can only work with the designation of administering agencies which have authority to sanction wayward jurisdictions. For example, can regional councils be developed to administer EAP which have appropriate representation from air pollution control and planning agencies and reasonable authority to deny permits to construct?

Emission density zoning has been proposed by Roberts, Croke and Booras[1] as the central land use control device for air quality management. It does represent a clearly-delineated connection between land use and pollutant emissions. As such, EDZ is easier to comprehend than EAP and is possibly easier to administer. Roberts, Croke and Booras develop an interesting integrated framework which utilizes both EDZ and transferable emission rights. The use of emission rights provides flexibility, permitting polluters requiring more land under EDZ regulations to purchase the rights to pollute from other adjacent landowners.

The proposal by the three authors deserves serious consideration. However, some of the objections raised earlier about EDZ should be mentioned. First, there is the potential legal problem of the taking issue. As argued earlier in Chapter Three, courts may find EDZ unconstitutionally burdensome if excessive investment in additional land were required in order to comply with the emission quota. Such a situation is likely to occur with land-intensive heavily-polluting sources. It seems also reasonable to assume that the requirement of purchasing an excessive amount of emission rights from nearby landowners will meet similar constitutional objections.

Second, EDZ may lead to increased dispersal of activities because polluters will seek large enough quantities of vacant land to satisfy emission quotas. Often, large amounts of vacant land are available on the fringe of metropolitan areas. Accompanying this spreading of development may be a corollary increase in vehicle-miles traveled. This increase in vehicle-miles, and the emissions generated, will occur if the journey-to-work average trip length of workers in the establishment is larger than would have occurred if the establishment were not located based on EDZ regulations. Correspondingly, vehicle-miles would also increase if automobiles rather than mass transit were more likely to be used at the site chosen because of EDZ regulations.

Finally, EDZ faces the issue of how the unit area emission quotas would be estimated. Earlier discussion in Chapter Four suggests that there is no easy resolution. It is not enough to say that the unit area quotas will be based on some estimate of future growth without clearly specifying on what basis the growth will be estimated and how the emission rates can be changed in the future if it is

determined that air quality is not being maintained.

Thusfar, the prospects and problems of emission allocation planning and emission density zoning have been discussed. The minimal attention given to district and floating zone emission quotas reflects their relatively weak role in air quality attainment and maintenance. Both DEQ and FZEQ face legal problems, as outlined in Chapter Three. Although DEQ may be useful as an indirect source control mechanism, additional research should be carried out before attempting implementation. Floating zone emission quotas may prove helpful in controlling hot spots. Additional experience with FZEQ, such as Jefferson County, Kentucky, would be necessary before the success of the device could be assessed in terms of hot spot control and legal viability.

Recommendations

There are two basic recommendations of this study. First, communities wishing to use one of the emission quota strategies discussed here should take great care to develop a technically sound, equitable, regulation that is well understood by the community. Until more experience is gained in the use of emission quota strategies, each success and each failure will be in the spotlight. Hastily prepared regulations can be harmful not just to the community that tries them, but to others that may be deterred from trying emission quota strategies because of the failure of the hastily prepared regulations.

The second recommendation is that additional research be carried out into the use of EAP and EDZ. Such research should focus on selected metropolitan areas which have: (1) strong planning efforts, including a well-developed data base on population, employment and land use, and (2) solid air quality data, including a well-developed monitoring network and a recent reliable emissions inventory. The purpose of the research would be to carry out an actual EAP and EDZ analyses which would include the numeric quotas to be assigned to jurisdictions and unit areas. Evaluation would be a necessary component of the research, including an analysis of the economic and political feasibility of the strategies. Only through the actual development of the quotas for a region within an integrated framework encompassing air quality objectives and land use planning can these two maintenance strategies, emission allocation planning and emission density zoning, be properly evaluated.

In summary, air quality maintenance may well require the kind of linkages between urban activity and pollutant emissions found in EAP and EDZ. More work needs to be done, but it is already apparent from this study that there are problems and prospects with the two strategies. Only through intensive continued research will the future of emission density zoning and emission allocation planning as air quality maintenence strategies be determined.

NOTES

1. J.J. Roberts, E.J. Croke, and S. Booras, A Critical Review of the Effect of Air Pollution Control Regulations on Land Use Planning, 25 J. Air Pollution Control Ass'n 500 (1975) [Hereinafter cited as Roberts, Croke, and Booras].

APPENDIX A

SUMMARY OF IMPACT OF SB 98 - AIR POLLUTION EMISSION LIMITS

THE SAN FRANCISCO BAY AREA

As Amended January 14, 1975

A. ESTABLISHMENT
   1. By act of the Legislature
B. REVISED POWERS OF THE STATE AIR RESOURCES BOARD
   1. By July 1, 1976, the board must declare Basinwide Air Pollution Control Coordinating Councils throughout the State as active. (In the Bay Area, the Bay Area Air Pollution Control District Board is the council.)
   2. The board shall establish air quality goals for each basin to achieve and maintain air quality "at or better" than State and Federal standards.
      a. If the board finds, after a public hearing, that maintenance of air quality is not compatible with State and basinwide social and economic goals, it may specify less stringent air quality goals.
      b. These less stringent goals must not be less than the health warning levels defined in the State Emergency Episode Contingency Plan.
   3. By July 1, 1977, the board shall establish allowable emission limits for each air basin for 10- and 20-year periods.
   4. The board shall:
      a. Prepare information on the quantity and type of air pollution emissions and their relationship to the type, category, density and extent of land use and development.
      b. Prepare and distribute guidelines for projecting air pollution emissions from land use categories and densities in land use plans and from transportation modes in transportation plans.
C. DUTIES OF THE BAY AREA AIR POLLUTION CONTROL DISTRICT (BAAPCD)
   1. By December 31, 1977, the district shall subdivide the air basin and allocate emission limits to each subdivision.
   2. The district board shall revise its orders, rules and regulations to be consistent with the allocation of emission limits.
      a. Revised regulations shall include those aimed at preventing the construction or operation of facilities directly or indirectly generating emissions that would cause allocated limits to be exceeded.
      b. Complex sources are defined to include but are not limited to airports, highways, shopping centers, and sports facilities.
   3. The board shall require the developer of any major project (including housing) inducing growth or having a significant impact on air quality to obtain a permit for the project from the air pollution control officer.
   4. The air pollution control officer shall not issue a permit for construction, alteration or operation of a project:

a. In a city or county that does not have a general plan approved by the district board.
b. For which emissions projected after December 31, 1986 will cause the emission limits allocated to the air basin subdivision, city or county to be exceeded.

5. The district must:
   a. Provide technical assistance to cities, counties, councils of government and regional transportation agencies on the preparation of general and transportation plans that conform to emission limits allocated to the Bay Area.
   b. Define projects likely to have a significant impact on air quality or are growth inducing.
   c. Review environmental impact reports.
   d. Review city and county general plans and regional land use and transportation plans, and approve those that it judges will maintain projected emissions within limits allocated to the city, county or air basin subdivision.
   e. Review applications to local agency formation comm'ssions and notify the commissions of any expected violations of air quality standards that will result from approval of applications.
   f. Appoint an advisory committee of experts in air resources, public health, land use and transportation planning, transportation operations, and industry, and agriculture.
6. The board may also establish bench mark years for the preparation of city and county general plans and regional land use and transportation plans.

D. IMPACT ON REGIONAL AND LOCAL AGENCIES

1. The Regional Transportation Plan of the Metropolitan Transportation Commission (MTC) must be consistent with the emission limits allocated for the air basin and its subdivisions.
   a. The plan's environmental impact statement must contain a report projecting emissions resulting from the proposed transportation system.
   b. MTC must obtain a statement from BAAPCD that emissions projected from the proposed transportation system will not cause the emission limits allocated to the air basin or its subdivisions to be exceeded.
2. Land use and circulation elements of city and county general plans must be amended within 1 year of the receipt of allocated emissions limits from BAAPCD so that projected land uses and transportation facilities shall not cause the emission limits allocated to the city, county or air basin subdivision to be exceeded.
3. If a city or county general plan is disapproved by the BAAPCD for failure to meet emission limits, the city or county shall submit within 3 months a revised plan and projection of emissions to BAAPCD for review.
4. Cities and counties are required to deny approval of final or tentative subdivision maps if it finds that the subdivision will cause emission limits allocated to the air basin subdivision within the city or county to be exceeded.
5. Local agency formation commissions would be required to consider the impact on air quality of any proposed city incorporation,

annexation or formation of special districts, and to submit to BAAPCD an air quality impact report on such proposals.

6. Public agency procedures for evaluating projects and preparing environmental impact reports shall cover emissions generated by proposals and whether they will cause emission limits to be exceeded.

E. REGIONAL AGENCY REORGANIZATION

1. When the State Air Resources Board determines that a multifunctional regional organization encompasses substantially an entire air basin and has responsibility for planning for air quality for the region, the multifunctional regional organization shall assume the responsibility for allocating emission limits from a basinwide council.

APPENDIX B

GLOSSARY OF LEGAL TERMS

DUE PROCESS; TAKING: The Due process requirement means that state and local regulations must serve some reasonably acceptable purpose under federal and state constitutions. Otherwise, the regulation will be held unconstitutional as a "taking" without Due Process of Law. As applied in the land regulation situation, a regulation that violates Due Process is a taking because it "takes" from the landowner without compensation the value of his land for the use which is prohibited by the regulation.

DELEGATION OF POWER: State and county administrative agencies and local governments may not exercise regulatory powers unless these powers have been conferred by state legislation. The term applied to the process through which state legislation confers these powers is known as "delegation of power."

PREEMPTION: This term refers to the displacement of the regulatory powers exercised at one level of government by comparable regulatory powers exercised by a higher level of government. Thus, the Clean Air Act provides that any air quality regulations adopted by EPA "preempt" any less stringent air quality regulations adopted by state and local governments.